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INSTRUCTION BOOK

LORAN-C MONITOR

TYPE FA-10232

SERIAL NOS.

CONTRACT DTFA01-87-C-00006
CONTRACTOR
FRONTIER ENGINEERING, INC.
424 SQUIRES ST.
STILLWATER, OK. 74075
MADE FOR

U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

MARCH 15, 1990

TD 4.6/2-2:

CONTRACTOR GUARANTEE

Frontier Engineering's LORAN-C Monitor, manufactured for the Federal Aviation Administration under contract number DTAF01-87-C-00006 is not manufactured as a commercial product.

Quality of workmanship is ensured by Internal Production and Acceptance Testing, which is monitored by both FEI and FAA Quality Representatives.

As a whole, the LORAN-C Monitor is not supplied with any other warranty than the warranties offered by those material manufacturers who supply the monitor's internal components.

LIST OF MODIFICATIONS TO SPECS

SECTION 10 - COMPUTER SOFTWARE

03/15/90	ALL LORAN-C MONITOR SOFTWARE MAY BE REFERENCED THROUGH THE DETAILED DESIGN DOCUMENT OR THE TOP-LEVEL DESIGN DOCUMENT.

EFFECTIVE PAGES

VALIDATION PERFORMANCE

TITLE OF DOCUMENT:

CONTRACTOR:

SUBCONTRACTOR:
(If performing validation)

APPLICABLE CONTRACT AND PURCHASE ORDER NUMBERS:

PARAGRAPH AND SUBPARAGRAPH NUMBERS (When applicable, list inclusive paragraphs; e.g., 4.21 thru 4.21.6)	DATE OF VALIDATION COMPLETION	CHECK BELOW IF NOT VALIDATED		C.O. VERIFICATION
			AUTHORITY	

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CONTRACTING OFFICER (FAA)

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TABLE OF CONTENTS

TECHNICAL INSTRUCTION BOOK

LORAN-C MONITOR

Paragraph		Page
SECTION 1 - GENERAL REQUIREMENTS		1-1
1.1	INTRODUCTION	1-1
1.1.1	Purpose	1-1
1.1.2	Scope	1-1
1.1.3	Applicability	1-1
1.2	EQUIPMENT DESCRIPTION	1-1
1.2.1	System Overview	1-1
1.2.1.1	Physical Description	1-1
1.2.1.2	Environmental Conditions	1-3
1.2.1.3	Major Assemblies	1-3
1.2.1.3.1	LORAN-C Receiver	1-4
1.2.1.3.2	Power Supply Unit	1-4
1.2.1.3.3	Monitor Processor Unit	1-4
1.2.1.3.4	LORAN-C Monitor Signal Generator	1-4
1.2.1.3.5	Remote Monitoring Subsystem	1-5
1.2.1.3.6	Monitor Processor Software	1-5
1.3	RELATIONSHIP OF UNITS	1-6
1.3.1.1	Equipment and Accessories Supplied	1-6
1.3.1.2	Equipment Required But Not Supplied	1-8
1.4	EQUIPMENT SPECIFICATION DATA	1-8
1.4.1	Nameplate Data	1-8
1.4.2	Environmental Data	1-8

Paragraph Page

1.4.3 Functional Characteristics 1-8

SECTION 2 - TECHNICAL DESCRIPTION 2-1

2.1 INTRODUCTION 2-1

2.2 BLOCK DIAGRAM THEORY 2-1

2.2.1 Monitor Overall Block Diagram Theory 2-1

2.2.2 Front Panel Display Block Diagram Theory 2-3

2.2.3 Receiver Block Diagram Theory 2-5

2.2.4 Simulator Block Diagram Theory 2-7

2.2.5 LORAN-C Processor Block Diagram Theory 2-7

2.2.6 Power Supply/Battery Pack Block Diagram Theory 2-9

2.2.7 Antenna Coupler Block Diagram Theory 2-11

2.3 DETAILED THEORY 2-13

2.3.1 Front Panel Display Detailed Theory 2-13

2.3.1.1 Display Select Circuit 2-13

2.3.1.2 Display 2-13

2.3.1.3 Status Indicators 2-14

2.3.2 Receiver Detailed Theory 2-14

2.3.2.1 RF Input Circuits 2-14

2.3.2.2 Notch Filters 2-16

2.3.2.3 Acquisition Circuits 2-16

2.3.2.4 Level Control Circuits 2-16

2.3.2.4.1 16-dB Circuit 2-16

2.3.2.4.2 4-dB Circuit 2-17

2.3.2.5 RF Amplifier 2-17

2.3.2.6 A/D Converter 2-17

2.3.2.7 Microprocessor 2-17

Paragraph		Page
2.3.2.8	Real-Time Clock, Gate Generator and DMA Address Control	2-17
2.3.3	Simulator Detailed Theory	2-19
2.3.3.1	Microprocessor/Controller	2-19
2.3.3.2	Digital LORAN Generator	2-19
2.3.3.3	Analog Signal Generator	2-19
2.3.3.4	Buffer/Driver	2-21
2.3.3.5	Simulator Serial Interface	2-21
2.3.4	LORAN-C Processor Detailed Theory	2-21
2.3.4.1	CPU	2-21
2.3.4.2	Watchdog Timer and Clock Generator Circuits	2-23
2.3.4.3	Nonvolatile Memory	2-25
2.3.4.4	System Configuration and Front Panel Indicator Circuits	2-25
2.3.4.5	Address Decoding and Chip Enable Circuits	2-27
2.3.4.6	External Communication	2-28
2.3.4.7	Internal Communication	2-29
2.3.4.8	Interrupt Control	2-29
2.3.4.9	Display	2-29
2.3.5	Power Supply/Battery Pack Detailed Theory	2-30
2.3.5.1	Power Supply	2-30
2.3.5.2	Battery Pack	2-31
2.3.6	Antenna Coupler Detailed Theory	2-31
SECTION 3 - OPERATION		3-1
3.1	INTRODUCTION	3-1
3.2	CONTROLS/INDICATORS	3-1
3.3	TURN ON/CHECKOUT	3-1

Paragraph Page

3.4. SYSTEM SHUTDOWN AND RESET CONTROL 3-1

3.5 REMOTE MONITORING AND CONTROL OVERVIEW 3-1

3.5.1 Fault Detection and Isolation 3-1

3.5.2 Automatic Ground Check and Analysis 3-1

3.5.3 Programmable Certification Parameter Counter 3-1

3.5.4 Certification Testing 3-1

3.5.5 Monitor Integrity Testing 3-1

3.5.6 Security Management 3-6

3.5.7 Password Procedures 3-6

3.5.8 Communication Control 3-7

3.6 OPERATOR INTERFACE FOR THE LORAN-C MONITOR SYSTEM 3-7

3.6.1 Screens and Command Structure 3-7

3.6.2 Detailed Screen and Command Descriptions 3-19

3.6.3 LORAN Directory Screen 3-20

3.6.4 LORAN Monitor Executive Data Screen 3-21

3.6.5 LORAN Monitor Recent Alarm History Screen 3-23

3.6.6 Monitor Certification Data Screen 3-24

3.6.7 Security Directory Screen 3-24

3.6.8 Maintenance Data Directory Screen 3-26

3.6.8.1 I14 FAULT Isolate Screen 3-27

3.6.8.2 I15 Monitor Test Data Screen 3-28

3.6.8.3 I16 10-Minute Average Screen 3-30

3.6.8.4 I17 4-Hour Data Screen 3-31

3.6.8.5 I18 Blink Data Screen 3-33

3.6.8.6 I19 1-Second Alarm Data Screen 3-34

Paragraph Page

3.6.8.7 I20 1 Minute Alarm Data Screen 3-36
3.6.9 Parameter Setup Directory and its Subdirectories 3-37
3.6.9.1 J1 Operating Parameters Screen 3-38
3.6.9.2 J2 Monitor Alarm Limits Screen 3-40
3.6.9.3 J5 Certification Generation Setup Screen 3-41
3.6.9.4 J9 LORAN Monitor Test Generation Setup Screen 3-42
3.6.9.5 J10 Future TD Correction Values Screen 3-43
3.6.10 Commands Run Tests Directory 3-43
3.6.11 Commands Maintenance Directory 3-44
3.7 Security Operations 3-44
3.7.1 Logon Password Level 3-45
3.7.2 Logon Lockout Level 3-45
3.7.3 Logon Safeguard Level 3-45
3.7.4 Change Security Keys 3-46
3.7.5 Logoff Monitor 3-46
3.7.6 Return to LORAN Directory 3-46
3.8 Front Panel LCD Display 3-47

SECTION 4 - STANDARDS/TOLERANCES

4.1 INTRODUCTION 4-1
4.2 STANDARDS AND TOLERANCES 4-1
4.2.1 Parameter 4-1
4.2.2 Procedure Paragraph Reference 4-1
4.2.3 Standard 4-1
4.2.4 Initial Tolerance Limit 4-1
4.2.5 Operating Tolerance Limit 4-1.

Paragraph		Page
SECTION 5 - PERIODIC MAINTENANCE		5-1
5.1	INTRODUCTION	5-1
5.1.1	General Requirements for Electrical/Electronic Equipment	5-1
5.1.2	General Requirements for Mechanical Equipment	5-1
5.2	PERFORMANCE CHECKS	5-1
5.3	OTHER ON-SITE MAINTENANCE	5-2
5.4	OFF-SITE MAINTENANCE	5-2
SECTION 6 - MAINTENANCE PROCEDURES		6-1
6.1	INTRODUCTION	6-1
6.2	PERFORMANCE CHECK PROCEDURES	6-1
6.2.1	LORAN-C Monitor Self Test	6-1
6.2.1.1	Self Test Procedure	6-1
6.2.2	LORAN-C Monitor Certification Test	6-2
6.2.3	Certification Test Procedure	6-3
6.2.4	CPU Timing	6-4
6.2.4.1	System Clock	6-4
6.2.4.2	Loran Clock	6-4
6.2.5	Power Supply	6-5
6.2.5.1	Unregulated DC Voltage	6-5
6.2.5.2	Vcc, Regulated 5 Vvolt Ssupply	6-5
6.2.5.3	+15 VDC Supply Voltage	6-5
6.2.5.4	Comparator Reference Voltage	6-5
6.2.5.5	24 VAC Supply	6-6
6.3	OTHER MAINTENANCE PROCEDURES	6-6
6.4	SPECIAL MAINTENANCE PROCEDURES	6-6

Paragraph Page

SECTION 7 - CORRECTIVE MAINTENANCE 7-1

7.1 INTRODUCTION 7-1

7.1.1 On-Site Failure Detection 7-1

7.1.1.1 LORAN-C Monitor Self Test 7-1

7.1.1.2 Certification Test 7-1

7.1.1.3 Fault Isolation Test 7-1

7.1.1.4 Monitor Test 7-1

7.2 On-Site Failure Detection Procedures 7-2

7.2.1 Fault Isolation Test Procedure 7-3

7.2.2 LORAN-C Monitor Test Procedure 7-3

7.3 ON-SITE CORRECTIVE MAINTENANCE 7-4

7.3.1 Fault Isolation to Replaceable Assembly or Component 7-4

7.3.1.1 Manual Fault Isolation Procedure for ACU, Simulator, Receiver 7-11

7.3.1.2 Manual Fault Isolation for ACU and Cabling 7-11

7.3.2 Clean-up Procedure 7-12

7.3.3 On-Site Removal/Replacement Procedures 7-12

7.3.3.1 Top Cover Removal/Replacement 7-13

7.3.3.2 Receiver Removal/Replacement 7-13

7.3.3.3 Simulator Removal/Replacement 7-14

7.3.3.4 LORAN-C Monitor Processor Removal/Replacement 7-14

7.3.3.4.1 EEPROM Modules Removal/Replacement 7-16

7.3.3.5 Power Supply/Battery Pack Removal/Replacement 7-17

7.3.3.5.1 Power Supply Removal/Replacement 7-17

7.3.3.5.2 Batteries Removal/Replacement 7-17

7.4 OFF-SITE CORRECTIVE MAINTENANCE 7-17

Paragraph		Page
7.4.1	Fault Isolation Procedures	7-18
7.4.1.1	Description of the LORAN-C Processor Test	7-18
7.4.1.1.1	Power Supply Test	7-18
7.4.1.1.2	System ROM Test	7-18
7.4.1.1.3	RAM Test Description	7-18
7.4.1.1.4	System Configuration Dipswitch Tests	7-19
7.4.1.1.5	Front Panel LED Test Description	7-19
7.4.1.1.6	LCD Display Test Description	7-19
7.4.1.1.7	EEPROM Subsystem Test Description	7-19
7.4.1.1.8	Internal/External Communications (UART) Test Descriptions	7-19
7.4.1.1.9	System Real-Time Clock Functional Test Description	7-19
7.4.1.1.10	Watchdog Timer Test Description	7-20
7.4.1.2	Equipment and Materials Required	7-20
7.4.1.3	Monitor Processor Test Procedure	7-20
7.4.1.3.1	Power Distribution Test	7-20
7.4.1.3.2	Clock Generator Test	7-22
7.4.1.3.3	CPU RAM Test	7-23
7.4.1.3.4	ROM Test	7-24
7.4.1.3.5	Wait State Generator Test	7-24
7.4.1.3.6	EEPROM Read/Write Test	7-25
7.4.1.3.7	System Configuration/Front Panel Indicator Functional Block Test	7-25
7.4.1.3.8	LCD Display Functional Block Test	7-26
7.4.1.3.9	UART Test	7-27
7.4.1.3.10	10-msec Interrupt Functional Block Test	7-27

Paragraph Page

7.4.1.3.11 Watchdog Timer Functional Block Test 7-27

7.4.1.4 Troubleshooting the Power Supply 7-27

7.4.1.4.1 Tools and Equipment Required. 7-28

7.4.1.4.2 Test Load for 5 V Power Supply 7-28

7.4.1.4.3 Test Load for +15 V Power Supply 7-28

7.4.1.4.4 Test Load for -15 V Power Supply 7-28

7.4.1.4.5 Load Test for 5 V Power Supply 7-28

7.4.1.4.6 Load Test for +15 V Power Supply 7-28

7.4.1.4.7 Load Test for -15 V Power Supply 7-29

7.4.1.4.8 Power Supply Troubleshooting Procedure 7-29

7.4.2 Removal/Replacement of Replaceable Components 7-30

7.4.2.1 LORAN-C Processor 7-30

7.4.2.2 Power Supply 7-30

7.4.2.2.1 Transformer Removal/Replacement 7-31

7.4.2.3 Front Panel Assembly Removal/Replacement 7-31

7.4.2.4 Front Panel LCD Display Removal/Replacement 7-31

7.4.2.5 Antenna Coupler Power Supply Removal/Replacement 7-32

7.5 OVERHAUL MAINTENANCE AND REPAIR STANDARDS 7-32

7.6 REMOVAL AND PACKING INSTRUCTIONS 7-32

7.6.1 REMOVING THE LORAN-C Monitor From Its Rack 7-32

7.6.2 Packing Instructions 7-33

SECTION 8 - PARTS LIST 8-1

SECTION 9 - INSTALLATION/INTEGRATION/CHECKOUT 9-1

9.1 INTRODUCTION 9-1

9.2 INSTALLATION 9-1

9.2.1 Unpacking and Handling 9-1

Paragraph		Page
9.2.2	Inspection Procedures	9-2
9.2.3	Installing the LORAN-C Monitor in Its Rack	9-2
9.3	INTEGRATION	9-2
9.4	SYSTEM STARTUP AND CHECKOUT	9-3
9.5	Packing for Reshipment	9-4
SECTION 10 -	COMPUTER SOFTWARE	10-1
SECTION 11 -	TROUBLESHOOTING SUPPORT DATA	11-1
APPENDIX A -	ABBREVIATIONS AND ACRONYMS	A-1
APPENDIX B -	ADDRESS ASSIGNMENTS	B-1

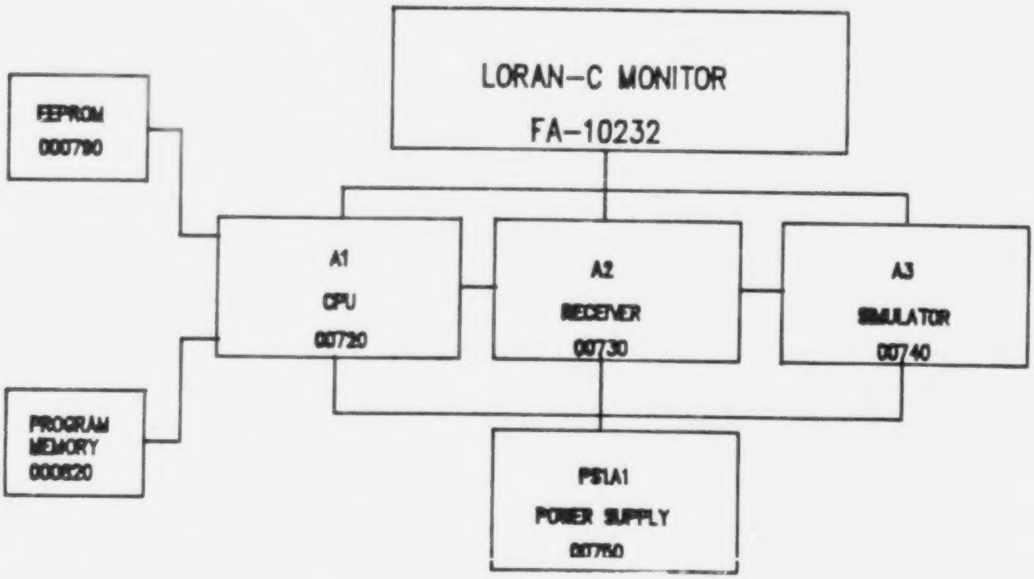
LIST OF FIGURES

Figure		Page
1-1.	LORAN-C Monitor, Overall View	1-2
1-2.	Relationship of Units	1-7
2-1.	LORAN-C Monitor Overall Functional Block Diagram	2-2
2-2.	Front Panel Display Functional Block Diagram	2-4
2-3.	Receiver Functional Block Diagram	2-6
2-4.	Simulator Functional Block Diagram	2-8
2-5.	Monitor Processor Functional Block Diagram	2-10
2-6.	Power Supply Functional Block Diagram	2-12
2-7.	Antenna Coupler Functional Block Diagram	2-15
2-8.	16-dB Attenuator, Simplified Schematic Diagram	2-18
2-9.	4-dB Attenuator, Simplified Schematic Diagram	2-20
2-10.	Antenna Coupler Interconnections	2-33
3-1.	Front Panel Controls and Indicators	3-2
3-2.	Rear Panel	3-3
3-3.	Screens and Command Structure	3-8
3-4.	A LORAN Directory Screen	3-20
3-5.	B Monitor Exec. Data Screen	3-21
3-6.	C LORAN Alarm History Screen	3-23
3-7.	D Monitor Cert Data Screen	3-24
3-8.	S Monitor Security Directory Screen	3-25
3-9.	I Maintenance Data Directory Screen	3-26
3-10.	I14 FAULT Isolate Screen	3-27
3-11.	I15 Monitor Test Data Screen	3-28

Figure		Page
3-12.	I16 10-Minute Average Screen	3-30
3-13.	I17 4-Hour Data Screen	3-31
3-14.	I18 Blink Data Screen	3-33
3-15.	I19 1-Second Alarm Data Screen	3-34
3-16.	I20 1-Minute Alarm Data Screen	3-36
3-17.	J Parameter Setup Directory Screen	3-37
3-18.	J1 Operating Parameters Screen	3-38
3-19.	J2 Monitor Alarm Limits Screen	3-40
3-20.	J5 Certification Generation Setup Screen	3-41
3-21.	J9 LORAN Monitor Test Generation Setup Screen	3-42
3-22.	J10 Future TD Correction Values Screen	3-43
3-23.	K Commands Run Tests Screen	3-43
3-24.	L Commands Maintenance Screen	3-44
3-25.	Front Panel LCD Display	3-48

LIST OF TABLES

Table		Page
1-1.	Equipment and Accessories	1-6
1-2.	Receiver Functional Characteristics	1-8
1-3.	External Power Data	1-11
2-1.	Antenna Coupler Test Points	2-32
1-4.	Monitor Processor Functional Characteristics	1-12
3-1.	Controls and Indicators	3-4
3-2.	Turn on/Checkout Procedures	3-5
3-3.	Command Structure Overview	3-8
3-4.	LORAN-C Monitor Security Access Structure	3-47
3-5.	LCD Display Parameters	3-48
4-1.	Standards and Tolerances	4-2
5-1.	Performance Checks	5-2
7-1.	On-Site Troubleshooting Procedure	7-4
7-2.	Power Supply Troubleshooting Procedure	7-29
9-1.	Configuration Switch Settings	9-3


LORAN-C MONITOR
FA-10232
EEPROM
000790
A1
CPU
00720
A2
RECEIVER
00730
A3
SIMULATOR
00740
PROGRAM
MEMORY
000820
PS1A1
POWER SUPPLY
00750

LORAN-C Monitor Family Tree

SECTION 1 - GENERAL REQUIREMENTS

1.1 INTRODUCTION.- This section provides general information on the LORAN-C Monitor System.

1.1.1 Purpose.- This Technical Instruction Book provides operation and maintenance instructions for the LORAN-C Monitor manufactured by Frontier Engineering, Inc., Stillwater, Oklahoma for the U.S. Department of Transportation, Federal Aviation Administration.

1.1.2 Scope.- This instruction book provides operation and maintenance instructions for the subject equipment as prescribed in Specification FAA-D-2494/b.

1.1.3 Applicability.- This instruction book applies to all equipment Type FA-10232 manufactured by Frontier Engineering, Inc., FSCM 63812, under contract DTFA01-87-C-00006.

1.2 EQUIPMENT DESCRIPTION.

1.2.1 System Overview.- This paragraph presents the physical description of the LORAN-C Monitor; describes the environmental conditions under which it operates; and gives a brief description of the major assemblies in the system.

1.2.1.1 Physical Description.- Figure 1-1 is an overall view of the LORAN-C Monitor. The LORAN-C Monitor System mounts in a standard 19-inch equipment rack. Overall dimensions of the LORAN-C Monitor System are:

19.000 inches wide x 5.219 inches high x 21.60 inches deep.

The aluminum chassis is strong enough to support all components and will withstand closure without warpage. The following items reside on the front panel of the monitor:

A. Two-pole POWER on-off switch.
B. Amber POWER-ON indicator, integral with power switch.
C. Green NORMAL status indicator.
D. Red ALARM status indicator.
E. Amber Signal ACQUISITION mode indicator.
F. Amber Signal TRACKING mode indicator.
G. DISPLAY SELECT switch.
H. LCD module for presenting received signal parameters. Each parameter is displayed by pressing the DISPLAY SELECT switch to advance to the next parameter in sequence. The following parameters are displayed in the indicated sequence:

1. Group repetition interval
2. Master SNR
3. Master ECD

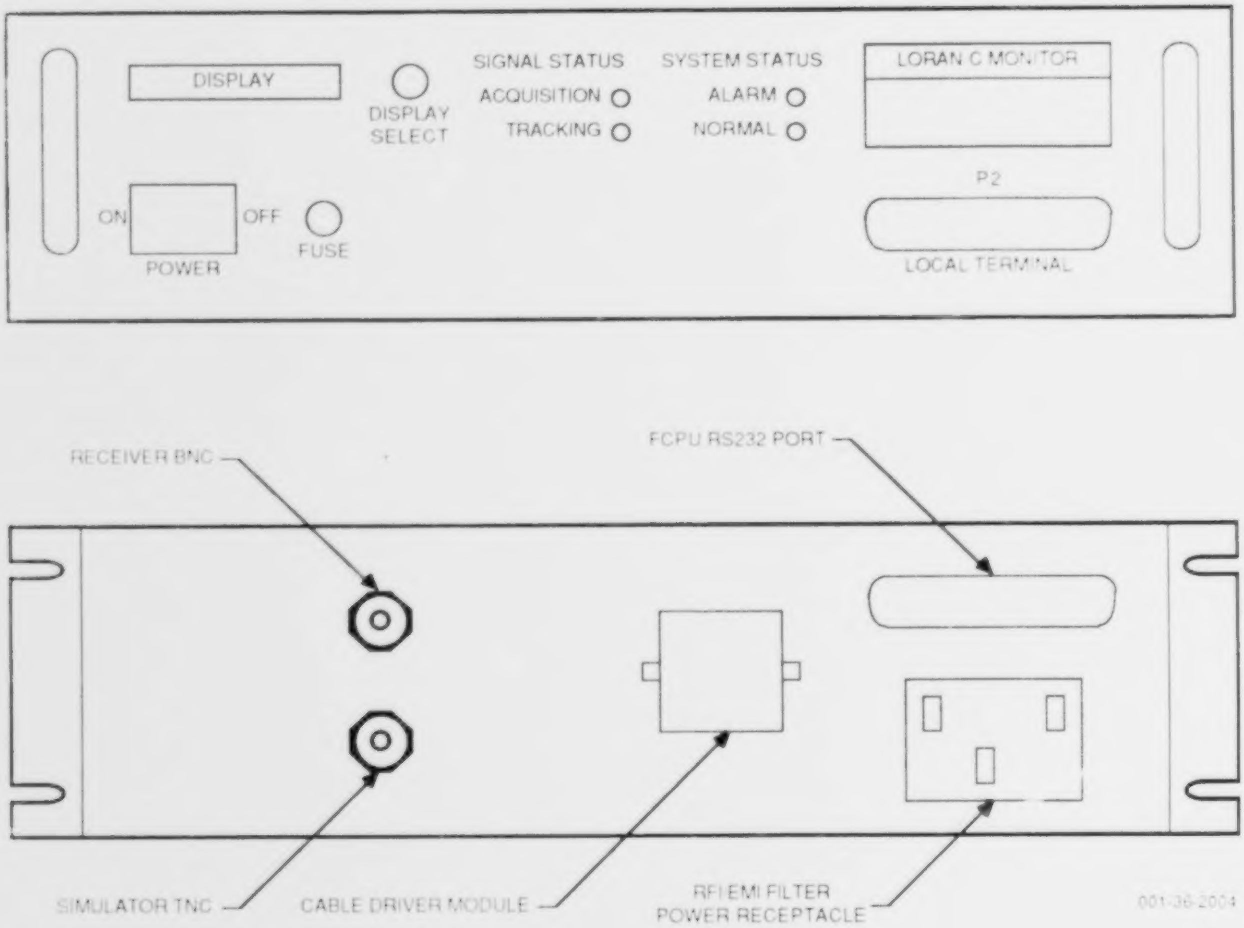

DISPLAY
DISPLAY SELECT
SIGNAL STATUS
ACQUISITION
TRACKING
SYSTEM STATUS
ALARM
NORMAL
LORAN C MONITOR
P2
LOCAL TERMINAL
ON
OFF
POWER
FUSE
RECEIVER BNC
FCPU RS232 PORT
SIMULATOR TNC
CABLE DRIVER MODULE
RFI/EMI FILTER
POWER RECEPTACLE
001-36-2004

FIGURE 1-1. LORAN-C Monitor Overall View

4. Secondary 1 SNR
5. Secondary 1 ECD
6. Secondary 1 time difference
7. Secondary 2 SNR
8. Secondary 2 ECD
9. Secondary 2 time difference

I. AC power fuse.
J. EIA-RS-232 port connector for IOT.

An EIA-RS-232 port connector for interface to the local terminal (IOT) resides on the front panel. An EIA-RS-232 port connector for interface to the FCPU resides on the rear panel. The receiver and simulator coaxial connectors are also on the rear panel. The receiver utilizes a BNC type connector, and the simulator utilizes a TNC type connector, providing the required keying for receiver and simulator connectors.

Keying for all other connectors is accomplished by one of the following methods: A) physical characteristics of the connector; B) polarizing slots and key; C) lead dress.

The power cord is a three-conductor cord assembly which uses 18 gauge wire with an IEC type plug. The mating connector, residing on the rear panel, is an IEC type configuration with integral EMI filter.

1.2.1.2 Environmental Conditions.- The system is designed to operate properly when subject to environmental condition II, Table III of FAA-G-2100d. The system is designed to operate properly from single phase, two wire plus ground AC line power sources with center values in accordance with Table IV of FAA-G-2100d for a 120 V, 60 Hz power source. The system will operate under the varying power source conditions also specified by that table.

1.2.1.3 Major Assemblies.- The system is designed in a modular configuration with six easily replaceable primary modules: power supply, receiver, simulator, monitor processor, program memory, and nonvolatile memory. Where practical, all electronic components reside on printed circuit boards. All printed circuit boards meet the requirements of FAA-G-2100d with the exception of the receiver and simulator boards, which are exempt by paragraph 3.3.8 of FAA-E-2762. The nonvolatile memory boards and the single program memory board, which are equipped with card guides and polarizing keys, reside in board edge connectors on the monitor processor board.

Test points are provided on the power supply and monitor processor modular assemblies. This allows easy verification of the presence of critical signals and voltage levels during testing and debugging.

All active electronic devices in the system are solid state. All diodes, transistors, and microelectronic devices were chosen in accordance with FAA-G-2100d, except those devices which reside on the receiver and simulator, which are exempt from this requirement by paragraph 3.3.10 of FAA-E-2762. Where necessary, RFAs have been submitted for devices not compliant with MIL-M-38510 requirements.

1.2.1.3.1 LORAN-C Receiver.- The LORAN-C receiver utilized in the system is capable of receiving all LORAN-C transmissions specified in COMDTINST M16562.4. Any two secondary stations of a chain of stations may be selected for a given GRI. The receiver stores the GRI in nonvolatile memory to eliminate the need for repetitive entry.

The receiver antenna is an 8-foot, one-piece Fiberglas whip. The antenna mounts directly to the coupler housing, which contains the signal switching circuitry for selection of either the antenna or the simulator as the signal source to the receiver. The coupler is designed to mount outdoors and will support the requirements of the receiver when subjected to environmental condition III in Table II of FAA-G-2100d. Coupler power is provided via a coupler power supply which resides on the rear panel of the monitor enclosure.

Signal-source selection is automatic. The coupler switches the signal source from the antenna to the simulator input upon power-up of the simulator by command from the monitor processor.

1.2.1.3.2 Power Supply Unit.- The power supply unit is capable of providing power to the monitor system by rectification and regulation of the 120 VAC, 60 Hz primary power supplied at the installation sites and falling within the requirements of Tables IV and V of FAA-G-2100d.

The power supply unit is also capable of providing backup power from the internal battery for a period of at least 30 seconds in the event of the loss of primary AC power. The unit is equipped with circuitry which will recharge the battery after use and maintain charge between uses.

Also incorporated in the power supply module is circuitry which continuously monitors the regulated +5 VDC and +15 VDC outputs as well as the battery output voltage. The circuitry sets a low voltage status bit which the monitor processor reads periodically in the event of a low output voltage condition. This circuitry is used by the diagnostic software to detect fault conditions in the power supply.

1.2.1.3.3 Monitor Processor Unit.- The monitor processor unit is designed to include the functionality of the RMS unit as an integral part of its own functionality. All functions of each unit are performed by a single microprocessor. Software for the monitor processor is documented as specified in MIL-STD-2167 and consists of DI-MCCCR-80018, "Computer System Operator's Manual," and DI-MCCR-80021, "Software Programmer's Manual."

The LORAN-C parameters are sampled and stored by the monitor processor unit as specified by FAA-E-2762, paragraphs 3.8.1 through 3.8.7.

1.2.1.3.4 LORAN-C Monitor Signal Generator.- The LORAN-C signal generator, which is used in the LORAN-C Monitor System, is a single board microprocessor controlled unit manufactured by Advanced Navigation, Inc.

The LORAN-C signal generator is capable of providing LORAN-C signals on command which are programmable with respect to GRI, ECD, SNR, time differences, and blink, in accordance with COMDTINST-M16562.4. Programmability of the signal generator is via the IOT or the FCPU.

On command from the monitor processor, the signal generator switches the source of the signal at the coupler to the simulator input. This action occurs automatically and cannot be initiated manually.

Extensive shielding around the signal generator prevents unwanted emissions of the LORAN-C signal from reaching the receiver.

1.2.1.3.5 Remote Monitoring Subsystem.- As mentioned above, the functionality of the remote monitoring subsystem has been designed to be integral with the monitor processor system. The required functions have been implemented in the Monitor Processor, which is a single microprocessor-based CPU board.

The CPU board contains the following: the microprocessor; 16 kbytes of RAM; 80 kbytes of program memory; communications controllers for the FCPU, IOT, and receiver/simulator communication ports; interrupt controller; and other circuitry necessary to perform the functions described in Section 3.10, as well as those functions required to be performed by the monitor processor system. For a complete functional description of each of the functional blocks of the CPU board, see the monitor processor theory of operation, Section 11.

The nonvolatile memory required for storage of the 4-hour averaged data and the alarm data is in the form of EEPROM devices. Twenty-four 8 kbyte devices residing on eight printed circuit modules provide 192 kbytes of nonvolatile storage. The EEPROM devices require no backup battery power for nonvolatility, thus simplifying the design. The eight modules are designed to plug into the CPU board using card edge connectors which are polarized with keys. The nonvolatile memory printed circuit modules have slots between two of the contacts of the edge connector.

The real-time clock required in the monitor system is provided in the form of a software clock. The software receives an interrupt on 10-ms intervals. This interrupt is used by the software as a time base to calculate time of day.

1.2.1.3.6 Monitor Processor Software.- The software which resides in the monitor processor module contains instructions for causing the monitor processor to perform the following functions:

1. Perform collection of all available data including certification, self-test, alarm, and averaged executive data.

2. Accommodate software and hardware interrupts for use in detecting faults, alarms, and changes in monitored data beyond the programmed limits.

3. Provide automatic storage of all required data in nonvolatile memory for future availability and record keeping.

4. Perform fault diagnosis to the lowest level replaceable board or module.

5. Provide a display of any measured parameter on the local terminal in a format similar to that specified in DR098390.

6. Provide the capability of obtaining from memory and displaying any stored data which has been identified by date and time, and to provide an indication of the source of the data.

7. Provide three levels of security as described in FAA-E-2762.

8. Provide communication internally to the system between the monitor processor and the receiver and simulator modules, as well as communication externally to the system between the monitor processor and the FCPU and the IOT.

1.3 RELATIONSHIP OF UNITS.- Figure 1-2 shows the relationship of units of the LORAN-C Monitor. It shows basic flow of information from the antenna and antenna coupler to the receiver and between the receiver, the monitor processor, and the Simulator. It also shows the interface between the LORAN-C Monitor and other FAA equipment. Table 1-1 lists the equipment and accessories.

1.3.1.1 Equipment and Accessories Supplied.- Equipment and accessories supplied are shown in Table 1-1.

Table 1-1. Equipment and Accessories

QUANTITY	NOMENCLATURE	FAA NUMBER	DIMENSIONS	WEIGHT AND VOLUME
1	LORAN-C Monitor	FA-10232	5.219" high 19.000" wide 21.60" deep	15 pounds (approx.) 1.15 cu. ft.
1	ANTENNA COUPLER	N.A.	9.41" high 4.75" wide 2.50" deep	N.A.

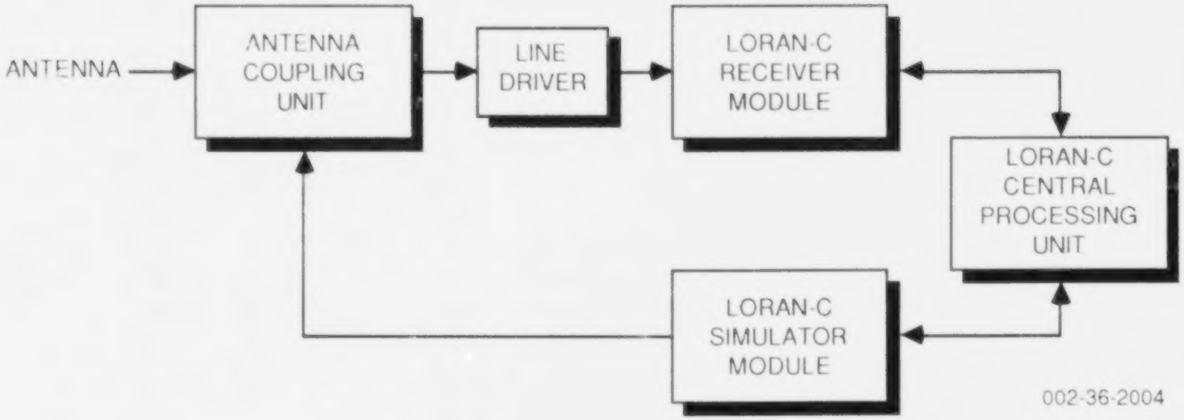

ANTENNA
ANTENNA COUPLING UNIT
LINE DRIVER
LORAN-C RECEIVER MODULE
LORAN-C CENTRAL PROCESSING UNIT
LORAN-C SIMULATOR MODULE
002-36-2004

FIGURE 1-2. Relationship of Unit

1.3.1.2 Equipment Required But Not Supplied.- All required equipment and accessories are provided with the LORAN-C Monitor.

1.4 EQUIPMENT SPECIFICATION DATA.- The following specifications are in accordance with the requirements of FAA-E-2762, including amendments 10/16/86, 6/5/87, and 6/27/87.

1.4.1 Nameplate Data.- The nameplate data for the LORAN-C Monitor are shown below.

LORAN-C MONITOR
MADE FOR
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
TYPE FA-10232 S/N
CONTRACT DTFA01-87-C-00006
FRONTIER ENGINEERING, INC.
FSCM 63812
STILLWATER, OKLAHOMA

1.4.2 Environmental Data.- The LORAN-C Monitor meets operating parameters when subject to environmental condition II, Table III of FAA-G-2100d, "Climatic Conditions," and input power requirements listed in Table 1.4 of this manual.

1.4.3 Functional Characteristics.- Table 1-2 lists the functional characteristics of the LORAN-C Monitor Receiver. Table 1-3 lists the external power data, and Table 1-4 lists the functional characteristics of the LORAN-C Monitor Processor.

Table 1-2. Receiver Functional Characteristics

Parameter	Value or Range
DIMENSIONS	N.A.
TUNING RANGE	As specified in COMDTINST M16562.4

Table 1-2. Receiver Functional Characteristics (cont.)

Parameter	Value or Range
ABSOLUTE ACCURACY	
T.D. Error	< 0.02 usec mean error and 0.02 usec s.d.
Absolute signal level	25 to 105 db/mV/m
Differential signal level	0 to 60 db
Absolute ECD	4.0 to -4.0 Msec for each signal
Differential ECD (Master to Secondary)	+/-4.0 Msec
Signal-to-Noise Ratio (SNR)	-10 db with respect to atmospheric or worse, received in a 30 kHz bandwidth
Continuous wave interference (CWI)	Greater than -20 db when a notch filter is used
Noise	One standard deviation of the time differences shall be less than 0.020 Msec at a SNR of 0 dB.
TRACKING	
The system shall maintain signal track over the following conditions:	
SNR	-23 dB with respect to atmospheric noise or worse.
CWI	The signal-to-CWI: -40 dB when a notch filter is used
ECD	+/- 4 microseconds.
Absolute signal level	The absolute signal level shall range between 10 to 120 dB/(1 uV/m).
REPEATABILITY	
T.D. Measurements	better than 0.020 Msec mean error and 0.02 Msec standard deviation for any receiver, or the same receiver, under identical signal conditions

Table 1-2. Receiver Functional Characteristics (cont.)

Parameter Value or Range

RECEIVER OUTPUTS TO LORAN-C PROCESSOR:

1. Time differences between the master and two selected secondary station signals with a resolution of 0.01 Msec
2. SNR for the master and the two selected secondary station signals expressed directly in dB with a precision of +/- 1 dB.
3. ECD values for the master and the two selected secondary station signals expressed in Msec with a precision of 0.1 Msec.
4. Upon the occurrence of Blink at a secondary station, Blink messages are generated within 12 seconds of initiation by the chain; the message identifies the station(s) being blinked.
5. A receiver status output is provided to show the current state of the receiver signal processing logic; this state indicates signal search and tracking within specifications.

NOTCH FILTERS

Three automatically tuned notch filters are provided. The minimum depth of each notch filter is -40 dB. All notch filters have a tuning range from 70 kHz to 130 kHz.

RECEIVER-FAIL SAFE PROVISIONS

The monitor receiver is fail safe in design, such that failure of any part(s) of the receiver will initiate an alarm condition or, as a minimum, will not cause the receiver to operate with a deteriorated radiated signal. For such parts as electronic switching devices where it is not practical to provide fail-safe operation under both modes of failure (open circuit and short circuit), fail-safe protection is provided for the mode of failure having the highest probability. At no setting of any of the controls is it possible to obtain no-alarm indication when the input signal to the receiver is removed completely.

RECEIVER ANTENNA AND ANTENNA COUPLER

The receiver antenna is an 8-foot whip antenna. The antenna and coupler will support the requirements of the receiver when subjected to environmental condition III in Table III of FAA-G-2100d, "Climatic Conditions." The receiver antenna coupler is capable of operating up to 500 feet from the LORAN-C receiver.

Table 1-3. External Power Data

Parameter	Characteristics
External Power	120 VAC, Single Phase 60 Hz, IAW Table IV of FAA-G-2100d, "Voltage Range Test Conditions," and varying power source conditions in Table V of FAA-G-2100d, "Equipment Performance Requirements versus Condition of AC Primary Input Power." The estimated power dissipation is approximately 40 watts, unity power factor. If primary power is lost, internal batteries which are capable of operating the LORAN-C Monitor normally for at least 30 seconds will supply backup power.

Table 1-4. Monitor Processor Functional Characteristics

Parameter	Value or Range
DIMENSIONS	8" by 12"
POSITION	Computed once per second, to a precision of 0.001 NM.
SIGNAL QUALITY	Receiver SNR is sampled and stored once per second. Resolution is 1 dB SNR.
ECD	Sampled and stored once per second. Resolution is 0.1 Msec.
BLINK	The processor stores the time a Blink signal is received, the identity of the secondary station, and the time at which the Blink signal is discontinued. Time is recorded to a resolution of 1 second.
ALARM GENERATION	When allowable position, SNR, or ECD limits have been exceeded or Blink occurs: (a) An alarm is made available to the FCPU (b) An alarm is made available to the local terminal port (c) Red lights on the monitor front panel are illuminated (d) The green lights on the monitor front panel are extinguished.
Position/ECD/SNR	Initiated if the allowable tolerances for any of these alarm parameters are exceeded in seven out of ten 1-second samples.
Blink Alarm	Initiated whenever a Blink signal persists for 12 seconds.
CLOCK	The accuracy of the clock is within 9 minutes over 60 days.

SECTION 2 - TECHNICAL DESCRIPTION

2.1 INTRODUCTION.- This section presents the theory of operation for the LORAN-C Monitor. Paragraph 2.2 presents the system theory of operation at the block diagram level while the detailed theory of operation is presented in paragraph 2.3. The system software is described in Section 10 of this manual.

2.2 BLOCK DIAGRAM THEORY.- This section summarizes the top-level hardware block diagram theory of operation of the LORAN-C Monitor System. For details of the LORAN-C Monitor hardware, refer to the Detailed Theory of Operation, Section 2.3.

2.2.1 Monitor Overall Block Diagram Theory.- See figure 2-1. The LORAN-C Monitor consists of an 8088 microprocessor-based CPU, a power supply, a front panel display, a LORAN-C Receiver, a LORAN-C Simulator; and an antenna coupler and antenna.

The CPU is an 8088-based single board microcomputer which consists of the necessary program memory, RAM, nonvolatile memory, serial communication ports, display control, and software needed to perform the specified functions and controls in the LORAN-C Monitor System.

The Power Supply is a DC-to-DC converter-based module which accepts standard single-phase 60 Hz primary power and supplies regulated +5, +/-15 VDC outputs for use throughout the LORAN Monitor System. The power supply is also equipped with circuitry which switches the source of primary power to backup batteries contained in the monitor when primary AC power is lost.

The power supply is capable of detecting the loss of AC power and switching to battery power without interruption of the normal operation of the LORAN Monitor System.

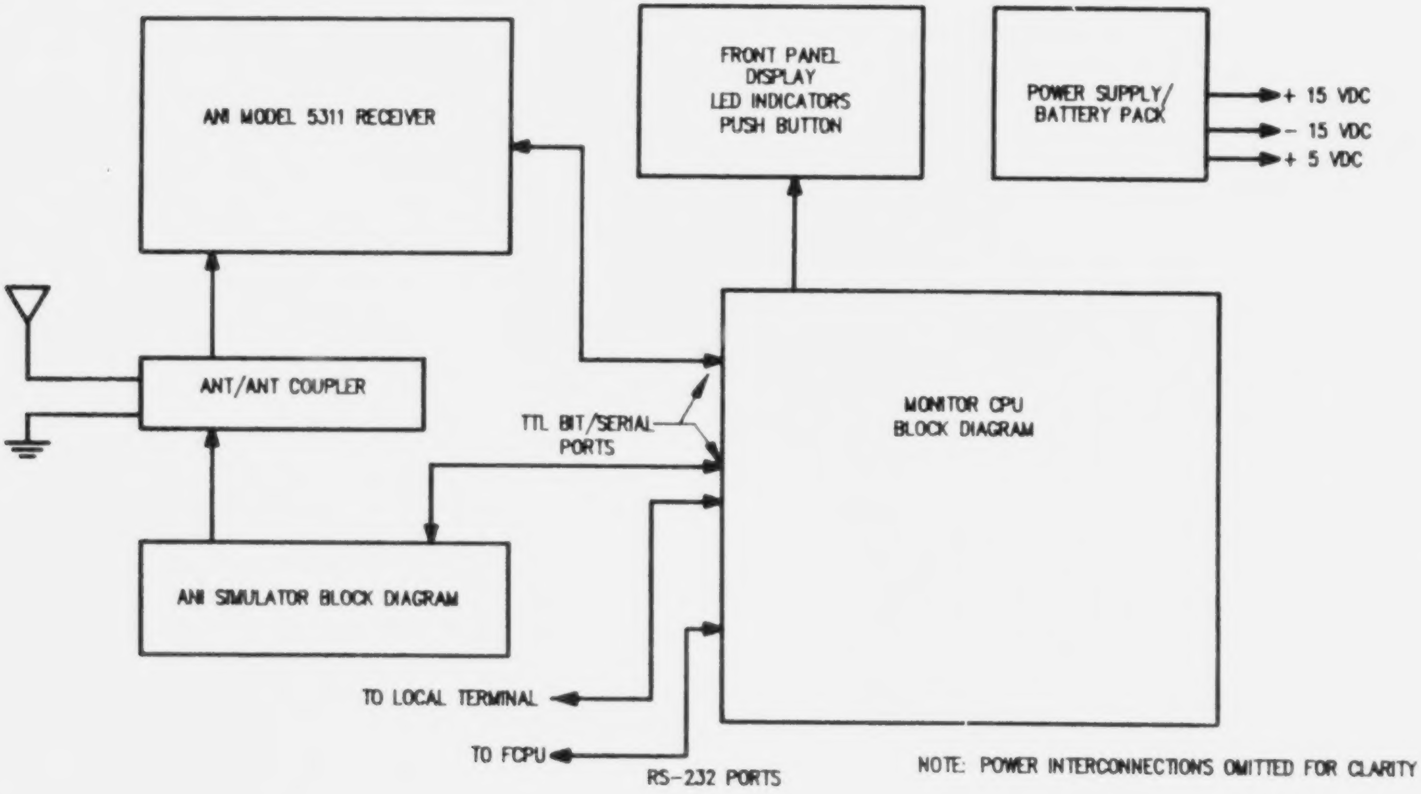
Circuitry is also provided which provides the proper charge current to the backup batteries when the batteries are not in use.

The front panel display is a self-contained liquid crystal display (LCD) module. The module receives data from the CPU band via a parallel port which is memory-mapped in the memory space of the CPU.

The LORAN-C Receiver is a single-board, microprocessor-based module which consists of all the components necessary to form a self-contained LORAN-C receiver. The module communicates with the CPU via a logic-level serial interface.

The receiver performs quantitative measurements of SNR, ECD, and time difference, and detects blink. The information is transmitted to the CPU upon command.

The LORAN-C Simulator is a single-board, microprocessor-based module which is capable of producing a LORAN-C signal which is fully compliant with COM DTINST-M16562.4.


ANI MODEL 5311 RECEIVER
FRONT PANEL
DISPLAY
LED INDICATORS
PUSH BUTTON
POWER SUPPLY/
BATTERY PACK
+ 15 VDC
- 15 VDC
+ 5 VDC
ANT/ANT COUPLER
TTL BIT/SERIAL
PORTS
MONITOR CPU
BLOCK DIAGRAM
ANI SIMULATOR BLOCK DIAGRAM
TO LOCAL TERMINAL
TO FCPU
RS-232 PORTS

NOTE: POWER INTERCONNECTIONS OMITTED FOR CLARITY

Figure 2-1. LORAN C Monitor Overall Functional Block Diagram

The simulator is capable of simulating LORAN-C transmissions of a master and two secondaries simultaneously.

The quantitative values of SNR, ECD, and time difference are independently programmable for each station, via the Test Certification Setup Screen, JS, and the Monitor Test Setup Screen, J9.

The Simulator communicates with the CPU via a TTL level serial port.

Power to the Simulator is controlled by the CPU and is not applied except during the execution of the various self-tests performed by the monitor.

Two external communication ports are provided on the LORAN-C Monitor. Each port is an asynchronous, RS-232 compliant serial port. The active pins on both ports are Transmit Data, Receive data, Protective Ground, and Signal Ground. All others are open connections. Both parts are configure as DCE.

The port on the front panel is intended for use with a local terminal. The baud rate is programmable and may be set at 300, 1200, or 2400 baud by using positions 5 and 6 of the DIP Switch A1S2 located on the CPU board.

The protocol used at the front panel port is the standard ASCII TTY protocol.

The port on the rear panel is intended for use with the VORTAC FCPU System. The baud rate is fixed at 1200 baud and the protocol is the VORTAC FCPU interface described by ICD098390.

The Antenna for the LORAN Monitor System is an 8-foot Fiberglas whip. It is attached directly to the antenna coupler housing.

The antenna coupler is an active device which conditions the antenna input and provides a balanced two-wire input to the cable driver located at the rear of the chassis. The coupler also incorporates circuitry which allows the CPU to select the source of the LORAN-C signal. The signal sources to the coupler are 1) the antenna and 2) the simulator. The antenna input is selected during normal operation of the monitor. The simulator input is selected during the execution of the various self-tests which may be performed by the monitor. The signal source is switched automatically for selection of the mode of operation of the monitor.

Power for the coupler is provided via the CPU board.

2.2.2 Front Panel Block Diagram Theory.- See figure 2-2. The front panel consists of the two-line LCD front panel display, four LED indicators, a DISPLAY SELECT push-button switch, a 25-pin RS-232 connector, and the Power ON/OFF Switch.

The front panel display is a module containing two lines of display. The necessary control and interface logic, consisting of a register select line, a read/write line, a device enable line; and the data lines are provided via the CPU board.

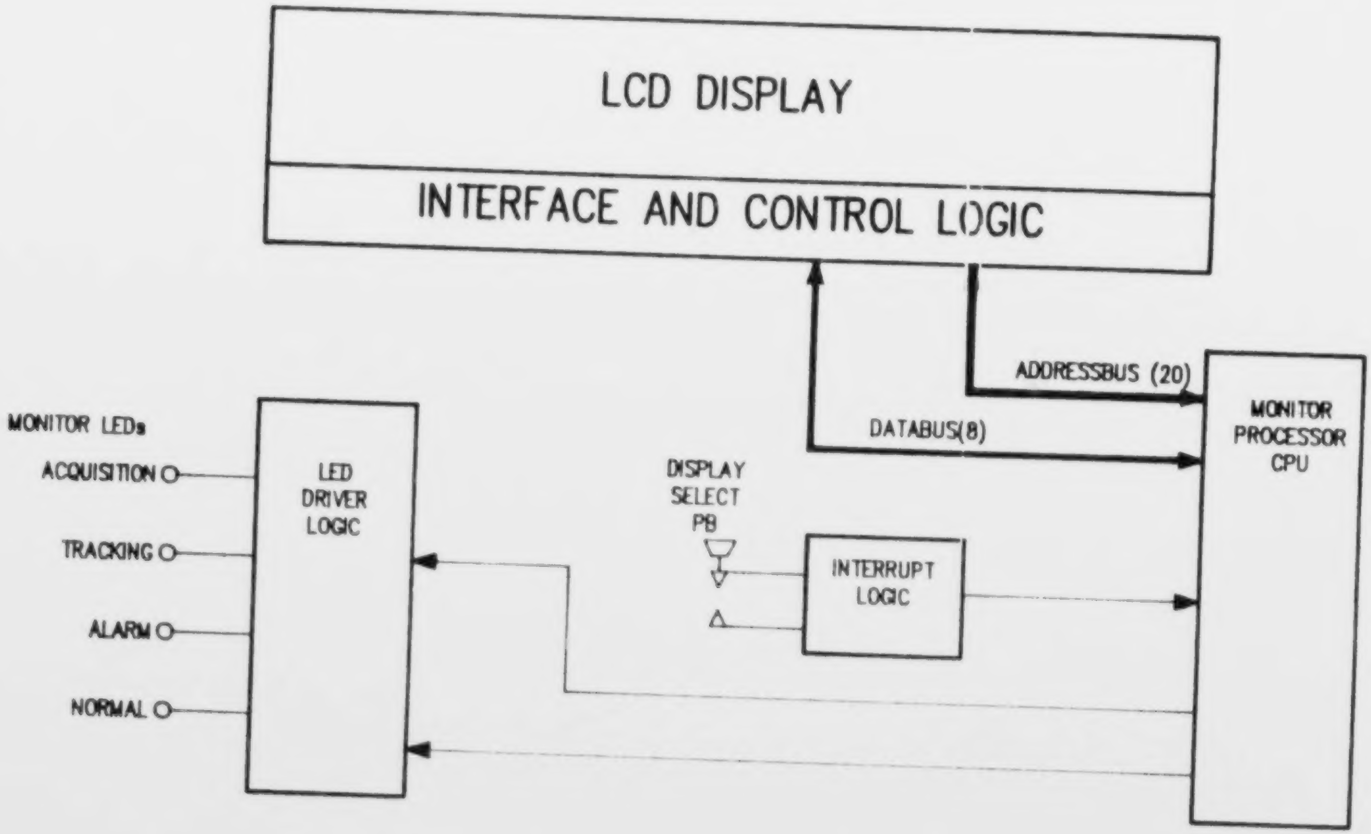

LCD DISPLAY
INTERFACE AND CONTROL LOGIC
ADDRESSBUS (20)
DATABUS(8)
MONITOR PROCESSOR CPU
MONITOR LEDs
ACQUISITION
TRACKING
ALARM
NORMAL
LED DRIVER LOGIC
DISPLAY SELECT PB
INTERRUPT LOGIC

Figure 2-2. Front Panel Display Functional Block Diagram

During normal start-up operation it takes the receiver from 3 to 6 minutes, depending on signal strength, to locate its signal and to lock on to it. Until the signal has been located, the ACQUISITION LED glows until the receiver has locked on. Then the TRACKING LED turns on. Also, if no alarm conditions have been detected, the NORMAL LED turns on. The NORMAL LED glows until an alarm condition is detected, at which time the ALARM LED turns on and the NORMAL LED turns off.

If any alarm condition exists, it will not be indicated until 2 minutes, minimum, have passed after the Tracking LED has been illuminated.

The DISPLAY SELECT push-button switch is used to scroll through the display of executive parameters in the LCD Module. Each press of the push button causes an interrupt to be generated and sent to the Monitor Processor CPU. The CPU responds by displaying the next two lines of information about the received signal parameters, e.g., the ECD, S/N Ratio, etc.

The Power ON/OFF switch is a single-throw, double-pole switch which controls the primary AC power input and the backup power from the batteries. Turning the switch ON illuminates the rocker, indicating that power is applied to the main transformer and the power supply. The batteries are also connected to the power supply when the switch is in the ON position.

2.2.3 Receiver Block Diagram Theory.- See figure 2-3. The Receiver consists of an RF input circuit followed by the notch filters which are controlled by the Notch Filter Interface Control. From the notch filters the signal goes to the RF amplifier and then the A/D converter, which digitizes the waveform. The Receiver also has a real-time clock, gate generator, DMA address control, and the acquisition circuit. All receiver timing and interface functions are controlled by the microprocessor unit.

A LORAN-C master signal has nine pulses and the secondary signals have eight. During receiver acquisition, the Receiver continuously samples the received signal at the specified GRI until it locates and locks on to the master station signal. The Receiver continues to digitize and seek the two secondary station pulses which were specified with the GRI.

Once the receiver has found the pulses it's seeking it searches for the zero crossing at the end of the third cycle of each pulse. This point is used as a timing reference in measuring the time differences.

Once the receiver has established the reference point, it computes the locations of the secondaries and measures the time of arrival of each secondary in microseconds, referenced to the third zero crossing of the Master. These times are used as the time differences needed for calculating the location of the receiver.

The receiver measures the time between the master pulse and the third cycle zero crossing of the next specified secondary. That time difference is Time Difference 1 (TD-1). Then it continues. It stores the value of TD1 and continues to measure time until it receives the second secondary pulse; then it measures that time, which is called TD2.

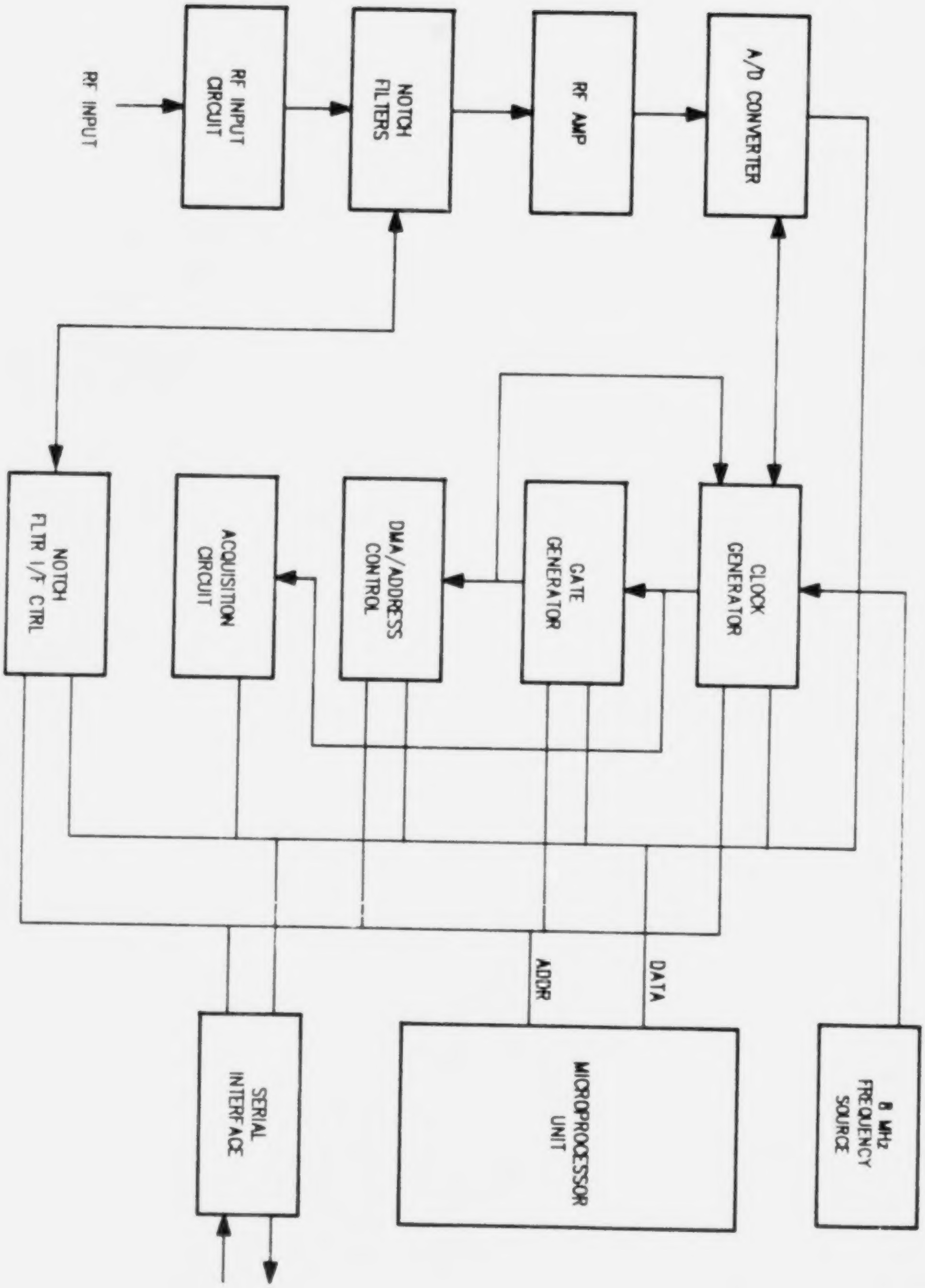

RF INPUT
RF INPUT CIRCUIT
NOTCH FILTERS
RF AMP
A/D CONVERTER
CLOCK GENERATOR
GATE GENERATOR
DMA/ADDRESS CONTROL
ACQUISITION CIRCUIT
NOTCH FLTR I/F CTRL
ADDR
DATA
SERIAL INTERFACE
MICROPROCESSOR UNIT
8 MHz FREQUENCY SOURCE

Figure 2-3. Receiver Functional Block Diagram

This process continues until the master and the correct set of secondaries have been identified. Then the receiver continues to sample the received signals and computes the TDs, ECD, and S/N Ratio. The Monitor Processor stores the values in RAM.

2.2.4 Simulator Block Diagram Theory.- See figure 2-4. Five functional blocks make up the Simulator. These are, the Simulator Serial Interface, the Microprocessor/Controller, the Digital LORAN Generator, the Analog Signal Generator, and the Buffer/Driver.

The Simulator Serial Interface function provides interface and control functions between the Simulator and the Monitor Processor. It uses TTL-level bit-serial asynchronous signals to interface with the Simulator Microprocessor/Controller.

The Microprocessor/Controller produces a digital signal which is converted to analog by the Digital LORAN Generator (DLG).

The Digital LORAN Generator produces an analog signal mixed with noise to simulate a received signal.

The Analog Signal Generator injects a calibrated noise signal. By varying the relationship of the noise amplitude and the signal generator signal strength, the receiver can simulate a signal of specified signal-to-noise ratio (SNR).

The Buffer/Driver matches the Impedance of the Simulator to the Impedance of the Receiver.

2.2.5 LORAN-C Processor Block Diagram Theory.- See figure 2-5. The Monitor Processor is made up of the following functional blocks:

1. CPU
2. Watchdog timer/clock generator
3. Nonvolatile memory
4. System configuration and front panel indicators
5. Address decoding/chip enable generation
6. External communication
7. Internal communication
8. Interrupt control
9. Display

The CPU is an Intel 80C88 Microprocessor, with an 8-bit external databus, a 16-bit internal databus, and a 20-bit addressbus. With the 20-bit addressbus, it is capable of directly addressing 1 mbyte of memory.

The Clock Generator and Watchdog Timer circuits create the master timing signals for the Monitor Processor.

The nonvolatile memory block is comprised of 24 8-kbyte EEPROM devices. This provides 192 kbytes of nonvolatile memory. The EEPROM devices provide read/write capability and nonvolatility without the use of backup batteries and the associated switchover circuitry.

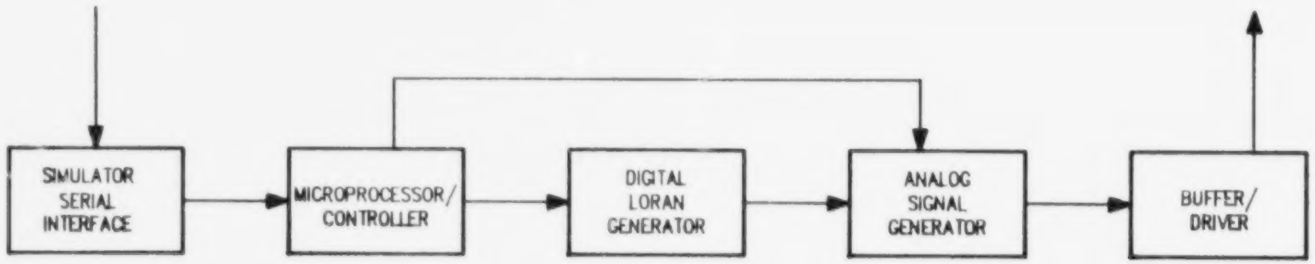

SIMULATOR
SERIAL
INTERFACE
MICROPROCESSOR/
CONTROLLER
DIGITAL
LORAN
GENERATOR
ANALOG
SIGNAL
GENERATOR
BUFFER/
DRIVER

Figure 2-4. Simulator Functional Block Diagram

The nonvolatile memory address space may be increased to 512 kbytes by using different nonvolatile memory boards populated with two 32-kbyte devices.

As the name implies, the System Configuration and Front Panel Indicator circuits perform two separate functions: they provide a programmable means of setting various functions within the LORAN-C Monitor; and they provide the drive signals for the front panel indicator LEDs.

The Address Decoding/Chip Enable circuits decode the addresses on the Address bus to provide chip Enable signals to select individual devices for microprocessor access. Effectively, this circuitry assigns each I/O device on the CPU board to a specific place in the Address space of the microprocessor.

External Communication circuits include Serial Ports 1 and 2 which are controlled by two separate UARTs to provide RS-232 links with the local terminal and the FCPU. These are asynchronous bit-serial ports.

Internal Communications circuits include Serial Ports 3 and 4 to the Receiver and Simulator. These are asynchronous bit serial ports. Ports 3 and 4 are controlled by a single UART, the input of which is routed to the appropriate port by the data selector, U41. Ports 3 and 4 are used to communicate with the LORAN Receiver and Simulator.

The interrupt controller handles traffic between the various interrupt devices and the CPU. These devices include the clock, the pushbutton on the display, and the serial ports.

The Display circuits handle the interface between the front panel DISPLAY SELECT push-button switch and the Interrupt Controller.

Thus, when the button is pressed, an interrupt is generated to the 80C88 CPU, which is programmed to advance the display to the next page when servicing this interrupt. When the button is released, the interrupt goes to the inactive low state.

2.2.6 Power Supply/Battery Pack Block Diagram Theory.- See figure 2-6. The LORAN Monitor Power Supply generates +5 and +/-15 VDC from a 120 VAC input. The supply comprises the following circuits:

- AC input and unregulated DC power supply
- DC-DC converter(s)
- Battery charger
- Voltage monitoring comparators
- Battery deep discharge protection

The 120 VAC power is connected to the unregulated DC power supply, which produces unregulated +24 VDC at its output. This DC voltage is filtered and applied to the input terminals of the DC-DC converter.

The DC-DC converter is a 25 watt self-contained module with a switching frequency in excess of 300 kHz. It accepts a DC input in the range of 19 to 35 VDC and provides regulated +5 and +/-15 VDC outputs. A second converter can be installed in parallel with the first one to provide an additional 25 watts output.

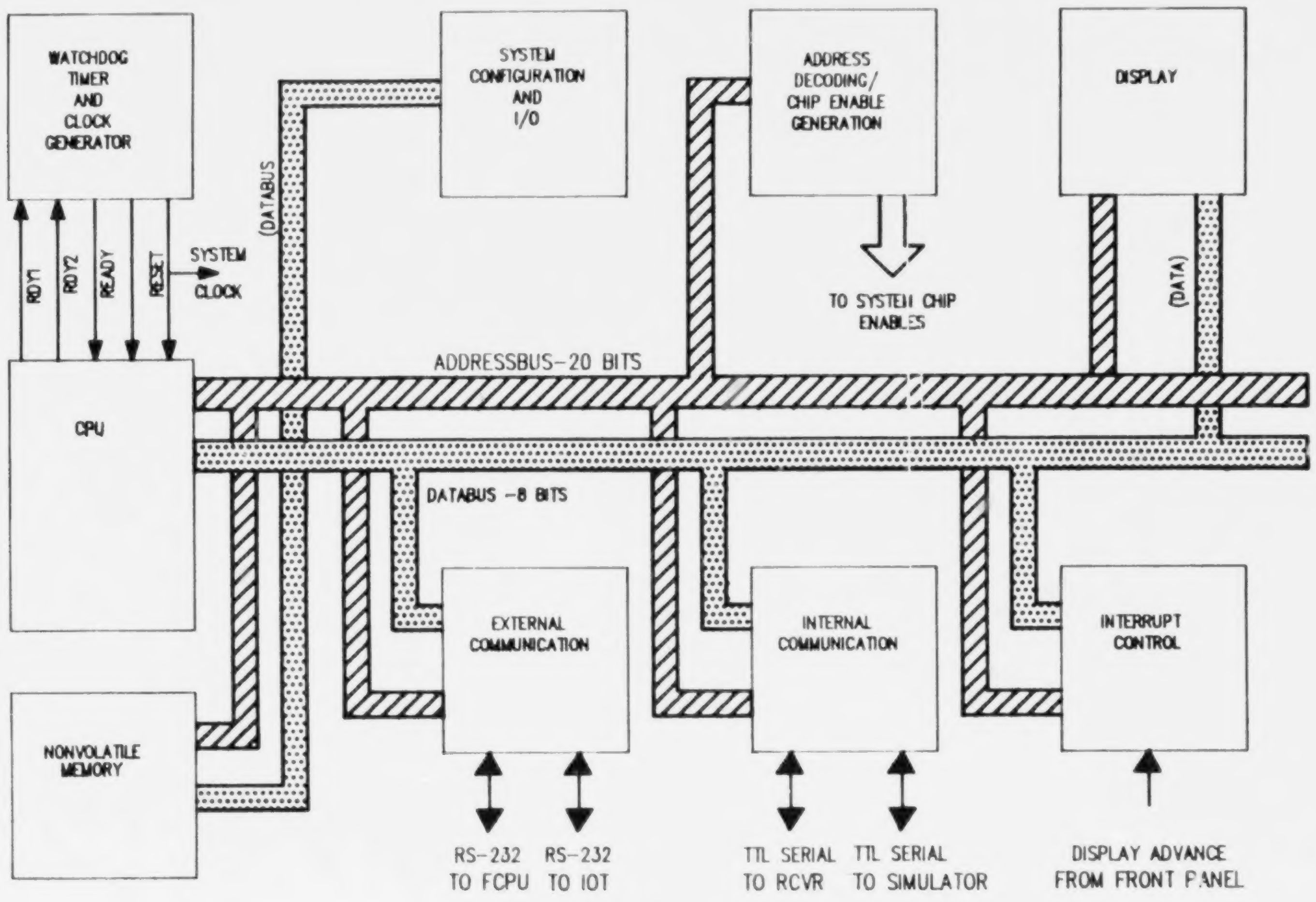

WATCHDOG TIMER AND CLOCK GENERATOR
RDY1
RDY2
READY
RESET
SYSTEM CLOCK
CPU
NONVOLATILE MEMORY
(DATABUS
SYSTEM CONFIGURATION AND I/O
ADDRESS DECODING/ CHIP ENABLE GENERATION
TO SYSTEM CHIP ENABLES
DISPLAY
(DATA)
ADDRESSBUS-20 BITS
DATABUS -8 BITS
EXTERNAL COMMUNICATION
INTERNAL COMMUNICATION
INTERRUPT CONTROL
RS-232 TO FCPU
RS-232 TO IOT
TTL SERIAL TO RCVR
TTL SERIAL TO SIMULATOR
DISPLAY ADVANCE FROM FRONT PANEL

Figure 2-5. Monitor Processor Functional Block Diagram

The battery charger circuit is programmed to charge a 24 V, 0.45AH battery set. A resistor network determines the overcharge and float charge voltage levels. The overcharge voltage is set at 29.9 V (2.5 V/cell) while the float charge is set at 27.6 Vs (2.3 Vs/cell). The charger IC provides temperature compensation (-3.9 mv/degC) in the overcharge and float charge modes.

When the battery has been sufficiently discharged, the recharge circuitry goes into a constant current bulk charge mode. In this state, the circuit is programmed to charge the battery at approximately a C/10 or 50 mA rate. A current sampling resistor samples the charging current in the bulk charge state.

Four independent comparators monitor critical voltage levels of the power supply. A single quad comparator is used and has open collector NPN ground referenced transistor outputs. A 4.3 V Zener diode provides a stable reference for all the comparators.

The two Low-Out comparators monitor the +5 and +15 supply outputs and signal the CPU if either of these voltages fall below a preset level. One comparator's output will transition from high to low when the +15 V supply drops below 14.4 V. The other comparator output will go low when the +5 V supply drops below 4.8 V. These comparator outputs are wired-on, so the CPU cannot distinguish between them.

The two Low-In comparators monitor the input voltage to the DC-DC converter. One comparator output will go low when the input voltage drops below 21 V. The other comparator disconnects the battery from the system to prevent excessive discharge.

The battery is normally connected to the system through a relay when AC power is present at the power supply rectifier bridge. When AC power fails, the relay remains energized because the battery is still supplying power to the system and the voltage is still above the comparator threshold. As the battery discharges, its output voltage drops until the cutoff threshold is reached and the relay is de-energized, disconnecting the battery from the system. This prevents deep-discharging the battery.

2.2.7 Antenna Coupler Block Diagram Theory.- See figure 2-7. Three functional blocks make up the Antenna Coupler circuits: the Antenna Matching Circuits; the bandpass Filter; and the Preamplifier.

The Antenna Matching Circuits compensate for relatively short antenna length and match the input impedance of the LORAN-C Monitor to the impedance of the antenna. Because of the low operating frequency of the LORAN-C transmitters, an antenna approaching even a fraction of a wavelength would be extremely long. Thus, it is necessary to use relatively short antenna elements and adjust the size electronically, by adding inductance in series. The Antenna Matching Circuits perform this function.

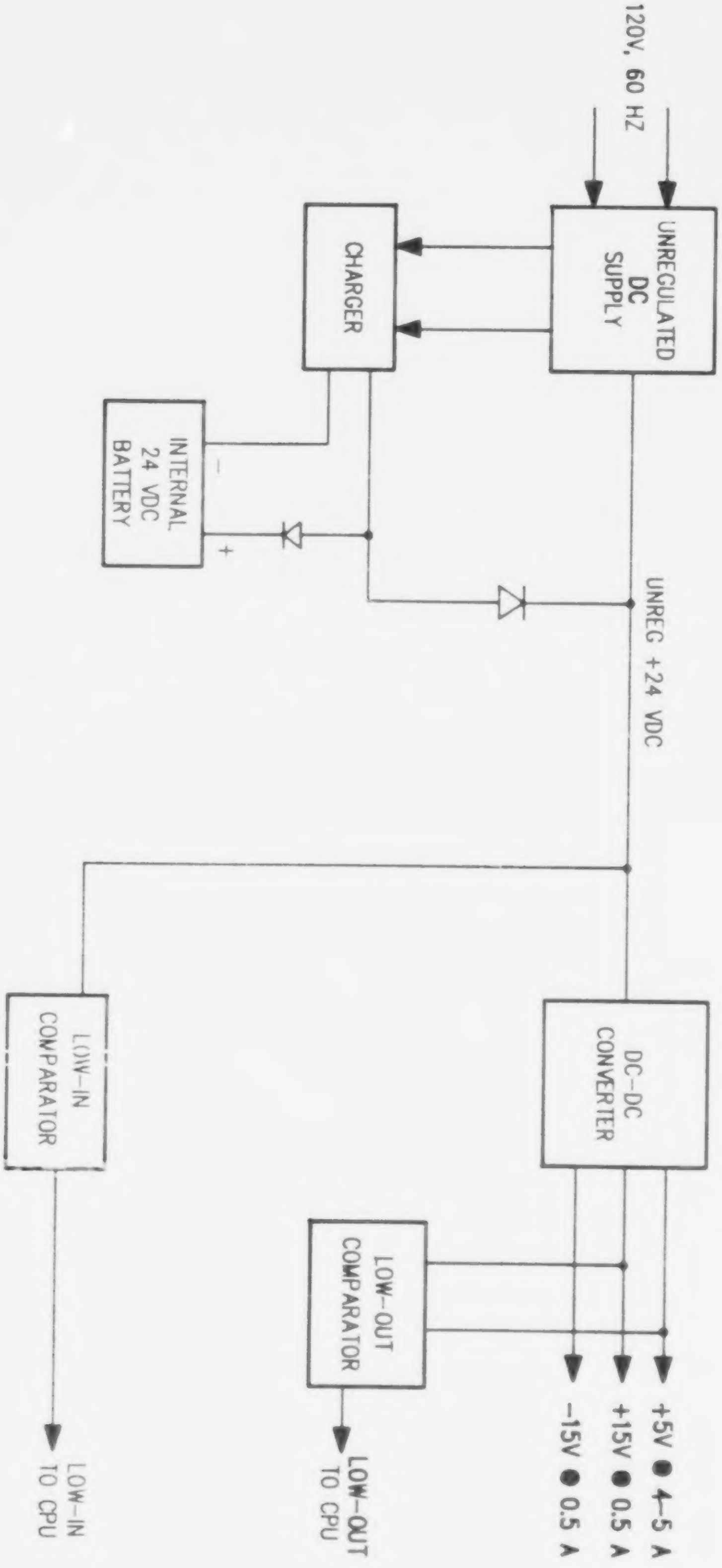

120V, 60 HZ
UNREGULATED DC SUPPLY
CHARGER
INTERNAL 24 VDC BATTERY
−
+
UNREG +24 VDC
DC-DC CONVERTER
LOW-IN COMPARATOR
LOW-OUT COMPARATOR
+5V ● 4-5 A
+15V ● 0.5 A
−15V ● 0.5 A
LOW-OUT TO CPU
LOW-IN TO CPU

Figure 2-6. Power Supply Functional Block Diagram

The bandpass filter provides increased selectivity and improved image rejection within the operating bandpass of the LORAN-C Monitor. An input connector is provided between the Antenna Matching Circuits and the Band Pass Filter. This connector is used for input from the Simulator during test operations.

The output of the bandpass filter is applied to the Preamplifier, which provides amplification and buffering between the Antenna Coupler and the LORAN-C Monitor Receiver. The output of the Preamplifier is connected to the LORAN-C Monitor Receiver through a matching transformer which provides "twin-ax" output coupling.

2.3 DETAILED THEORY.- This paragraph presents the detailed theory of operation for the LORAN-C Monitor. Organization of this paragraph closely follows the organization of the block diagram theory of operation presented in Paragraph 2.2. The Monitor Processor Detailed block diagram in Section 11 also applies to discussions other than the Monitor Processor. For each of these discussions, reference the appropriate schematic diagram in Section 11. Also, the printed circuit assembly drawing of the assembly under discussion will help in locating the various devices during troubleshooting or maintenance.

2.3.1 Front Panel Display Detailed Theory.- See the Monitor Processor detailed block diagram and its logic diagram, both in Section 11. The front panel circuits comprise three major functions: the push-button switch input and interrupt circuit; the LCD display circuit; and the four LED indicators.

2.3.1.1 Display Select Circuit.- The "D" flip-flop (U16) debounces the input of the DISPLAY SELECT pushbutton on the front panel. The pushbutton is a single-pole, double-throw switch which connects one of two terminals to ground when it is pressed, and the other when it is released. The normally open terminal is connected to the preset input, pin 4, and the normally closed terminal is connected to the clear input, pin 1, of the flip-flop.

When the button is pressed, the normally open contact is closed, causing the preset input to be pulled to ground and presetting the flip-flop. This causes a rising edge to be applied to Interrupt 7, generating an interrupt to the 8088, which is programmed to advance the display to the next page when servicing this interrupt. When the button is released, the flip-flop is cleared and Interrupt 7 goes to the inactive low state.

Since the flip-flop is preset or cleared on the first application of the low level, the contact bounce of the pushbutton is ignored and the switch is debounced.

2.3.1.2 Display.- The display circuits consist of the 54LS245 bidirectional buffer (U23) and the 54LS74 "D" flipflop (U16).

The buffer provides protection for the CPU board from shorts or other inadvertent off-board occurrences which could cause damage to the unit.

The Data Transmit/Receive (DT/R) signal from the 8088 is applied to pin 1 of the buffer for control of the direction. DT/R is low during a read, causing the buffer to drive in the B to A direction. DT/R is high during a write, causing the buffer to drive from A to B.

The display chip enable is used to enable the output of the buffer. The chip enable signal is applied to pin 19. An active low level enables the outputs. The chip enable signal also gates the "E" signal at pin 10 of the AND gate (U8) and generates the "enable" signal to the display.

The "E" signal at pin 10 of the AND gate (U8) which clocks the data into or out of the display is generated by U17 in the CPU circuits. All other signals are bus control and data signals from the microprocessor.

2.3.1.3 Status Indicators.- The front panel Status Indicators are driven by the output port comprised of U22, a 54ALS573 octal latch.

A data byte is written to U22 by asserting a WR (write) signal while the chip enable (CE5) is active. The resulting signal from the OR gate (U12) is applied to the latch input of U22, pin 11. When the latch input is high, the outputs of the device follow the inputs. When the latch input is taken low, the outputs are latched and remain in that logic state until the latch input is taken high again.

Four of the outputs of U22 are used to drive the front panel indicators, as shown below.

BIT 4: Drives Signal ACQUISITION indicator
BIT 5: Drives Signal TRACKING indicator
BIT 6: Drives ALARM indicator
BIT 7: Drives NORMAL indicator

These bits are used with 2N2222A transistors Q2, Q3, Q4, and Q5, to increase the current control capacity of U22.

2.3.2 Receiver Detailed Theory.- Reference Receiver Schematic Diagram in Section 11. The Receiver is made up of the RF Input Circuits, three programmable notch filters, the signal acquisition circuits, an RF amplifier, an A/D converter; a microprocessor; and a Programmable Logic Array (PAL).

2.3.2.1 RF Input Circuits.- The RF Input Circuits are made up of transistor Q1 and the two elements of amplifier U1. Transistor Q1 is a common base amplifier to provide high voltage gain while matching the low impedance antenna input circuits to the RF Amplifier input. Inductors L3 and L4 provide tuning for the RF Input circuits.

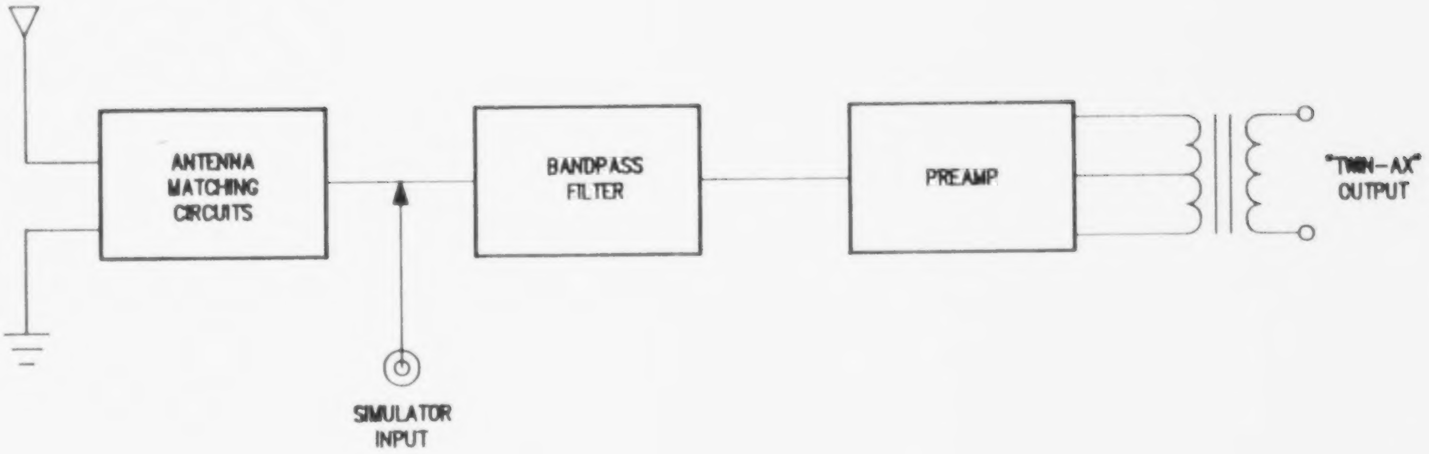

ANTENNA MATCHING CIRCUITS
SIMULATOR INPUT
BANDPASS FILTER
PREAMP
"TWIN-AX" OUTPUT

Figure 2-7. Antenna Coupler Functional Block Diagram

2.3.2.2 Notch Filters.- The four elements of U2, plus transistors Q2, Q3, Q4, and Q5, make up notch filter "A." Notch filters "B" and "C" are similarly constructed. The notch filter control circuits are made up of U7 through U12, plus the tuning circuits U18 through U24.

2.3.2.3 Acquisition Circuits.- The outputs of the three notch filters are cascaded, with the output of notch filter "C" being applied to the 2-stage Acquisition Filter U5. The single-ended output of U5 is converted to differential output by U6 before being applied to the level control circuits consisting of U13, U14, U15, and U16.

2.3.2.4 Level Control Circuits.- See page 2 of the Receiver Logic Diagram in Section 11. Two examples are presented here. First is the 16-dB circuit, followed by the 4-dB circuit. All of the gain control circuits use one or more elements of an MC14053 Triple 2-input Analog Multiplexer and work like one or the other of these two examples.

The MC14053 has three devices in one package. Each device has two signal inputs, "A", and "B". Each device also has its own Control (CNT) input and a common Inhibit (INH) line connects to all three devices (pin 6).

Here is a summary of the truth table for any one of the three devices:

1. The INH line (pin 6) must be LOW before either input can be connected to the output.

2. If the INH pin is HI, all outputs are placed in the high impedance state.

3. If the CNT input is LO (with INH LOW), IN A connects to OUT.

4. If the CNT input is HI (with INH LOW), IN B connects to OUT.

5. The device is bidirectional. That is, signal flow can be from OUT to the active IN line just as well as from IN to OUT. This characteristic is used in the 4-dB circuit which is explained later.

Two elements of U16 are used for the 4-dB and 16-dB gain circuits. The stage on the left is the 4-dB circuit; the one on the right is the 16-dB circuit.

2.3.2.4.1 16-dB Circuit.- The complete 16-dB circuit comprises R154, R155 and the right-most element of U16. Figure 2-8 is a simplified schematic diagram of this circuit.

Note that the input to the 16-dB circuit is from the junction of R153 and pin 13 of the 4-dB circuit. This input connects to the junction of pin 1 (INB) and R154. R154 and R155 form a voltage divider with the tap at pin 2 connected to INA (pin 2).

All of the input signal is applied to INB. The signal at INA is a fraction of the input, with the value depending on the ratio of R155 to the total resistance of the voltage divider.

When CNT (pin 10) is HI, INB connects to OUT (15) and all of the input signal is applied to the input of the next stage. But when CNT is LOW, INA connects to OUT (15), and the signal driving the next stage is reduced. This is summarized in the following discussion.

$$V_b = V_{in}$$

$$V_a = (R155/R154+R155) \times V_{in}$$

$$V_a = \frac{402}{2.552} \times V_{in}$$

$$V_a = 0.158 \times V_{in}$$

Gain (or loss) in dB = 20 log(0.158)

Gain (or loss) = 16 dB

Conclusion: When CNT is LO, INA connects to OUT and the signal driving the next stage is 16-dB lower than when CNT is HI.

2.3.2.4.2 4-dB Circuit.- The complete 4-dB circuit comprises R153, R154, R155, and the left-most element of U16. Figure 2-9 is a simplified schematic diagram of this circuit.

Note that the input to the 4-dB circuit is from U15 and is applied to pin 14 of U16; this pin is labeled OUT. Effectively, the input signal at pin 14 connects to the arm of a single-pole, double-throw switch. With CNT (11) LO, the switch connects to INA (12). With CNT HI, the switch connects to INB (13). The output of this stage connects to the input of the 16-dB stage.

The arithmetic is similar to that for the 16-dB stage described previously. The values of the 3-resistor divider are such that when INA is selected (CNT LOW), the signal applied to pin 1 is 4 dB lower than when CNT is HI.

Similar circuits are also used in the Simulator.

2.3.2.5 RF Amplifier.- The output of U15 is routed through U20 to the final RF amplifier U20 and then to the analog-to-digital converter (ADC) U33.

2.3.2.6 A/D Converter.- The ADC U33 digitizes the input signal and on software command, makes it available to the databus through data latch U34.

2.3.2.7 Microprocessor.- The Microprocessor, U28, is a Motorola 68B09E Microprocessor. This device has an 8-bit databus and a 16-bit addressbus. The 16-bit addressbus gives the 68B09E a 64-kbyte address space. Instructions for the CPU are stored in PROM U29, while RAM device U30 is for temporary storage of data and instructions. The top 56 kbytes of U29 are accessible only if enabled by the PAL U31. Address line A13 and the chip enable line, pin 22, are activated by the PAL.

2.3.2.8 Real-Time Clock, Gate Generator, and DMA Address Control.-These functions are performed by the Programmable Logic Array U31 (PAL). The PAL is a complex device using Large Scale Integration (LSI). The PAL is programmed to handle many of the critical timing and control tasks in the Receiver.

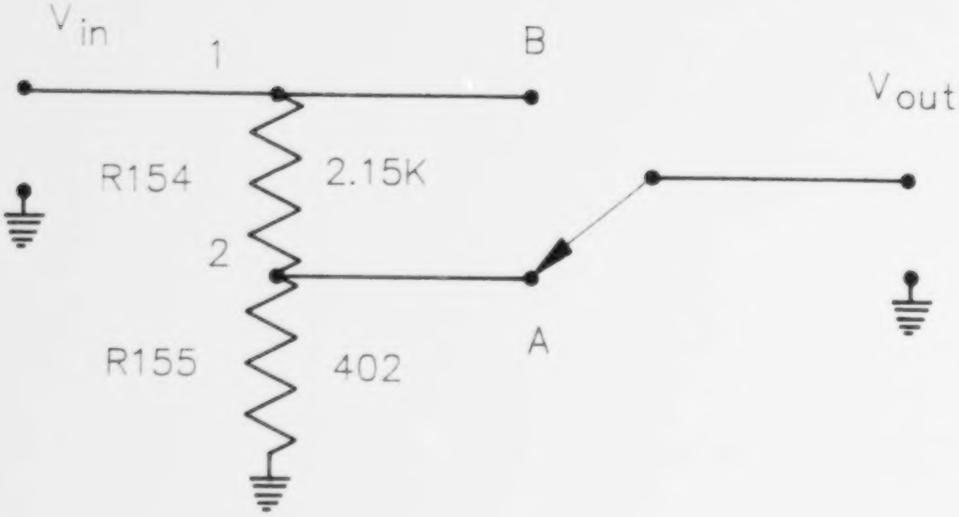

V in
1
B
V out
R154
2.15K
2
A
R155
402

Figure 2-8. 16-DB Attenuator, Simplified Schematic Diagram

2.3.3 Simulator Detailed Theory.- Reference the Simulator Schematic Diagram in Section 11. The main functions of the simulator are the microprocessor/controller; the analog signal generator; the LORAN signal generator; the buffer/driver circuits and the serial interface circuits. The microprocessor/controller executes instructions stored in Programmable Read Only Memory (PROM). The LORAN signal generator creates a pure RF signal that simulates the RF portion of a received signal; and the analog signal generator creates a calibrated noise signal to simulate the noise component of a real received signal. The serial interface circuits provide the communications path between the Simulator and the outside world. The buffer/driver circuits provide signal gain and impedance matching between the RF section of the Simulator and the LORAN-C Monitor Receiver.

2.3.3.1 Microprocessor/Controller.- U2 is a Motorola 68B09E Microprocessor. This device has an 8-bit databus and a 16-bit addressbus. The 16-bit addressbus gives the 68B09E a 64-kbyte address space. Instructions for the CPU are stored in PROM U3, while RAM device U4 is for temporary storage of data and instructions. The top 56 kbytes of U3 are accessible only if enabled by the Custom LORAN Device U6 (CLD). Address line A13 and the chip enable line, pin 22, are activated by the CLD.

2.3.3.2 Digital LORAN Generator.- Logic Cell Array U7 is programmed to produce an 8-bit digitized LORAN-C signal at LDAT outputs LDAT_0 through LDAT_7. These outputs are applied as a data word to the input of digital-to-analog converter (DAC) U10, which produces an analog LORAN-C signal at its pin 4. Noninverting amplifier U11 provides signal gain and impedance matching between the DAC and the programmable attenuator string which follows. The programmable attenuator is made up of three elements of U9 and four elements of U13. These stages work similarly to the operation of the level control circuits of the Receiver, described previously. Individual decibel attenuations of 1,2,4,8,16, and 32 dB are provided. Actual signal level at the output of the amplifier string is controlled by the CLD U6. The signals exercising this control are designated LRN_1dB through LRN_32dB #1 and LRN_32dB #2. With none of the attenuators activated, the amplifier string acts as one large voltage follower between the DAC and the RF output. With this scheme, a wide variety of output signal amplitudes is possible.

2.3.3.3 Analog Signal Generator.- Logic Cell Array U7 is programmed to produce an analog noise signal at pin 42. This output is applied to the programmable attenuator string made up of parts of U21, U23, and U24. Except for device numbers, the action of the attenuator string for the noise signal is almost identical to the action of that previously described for the LORAN-C signal. Thus, the noise signal is also programmable for a wide variety of signal levels.

Taken together, the LORAN-C signal generator and the Analog noise generator make it possible to mix the LORAN-C and noise signals to simulate a wide range of signal-to-noise ratios. This mixing occurs in the buffer/driver.

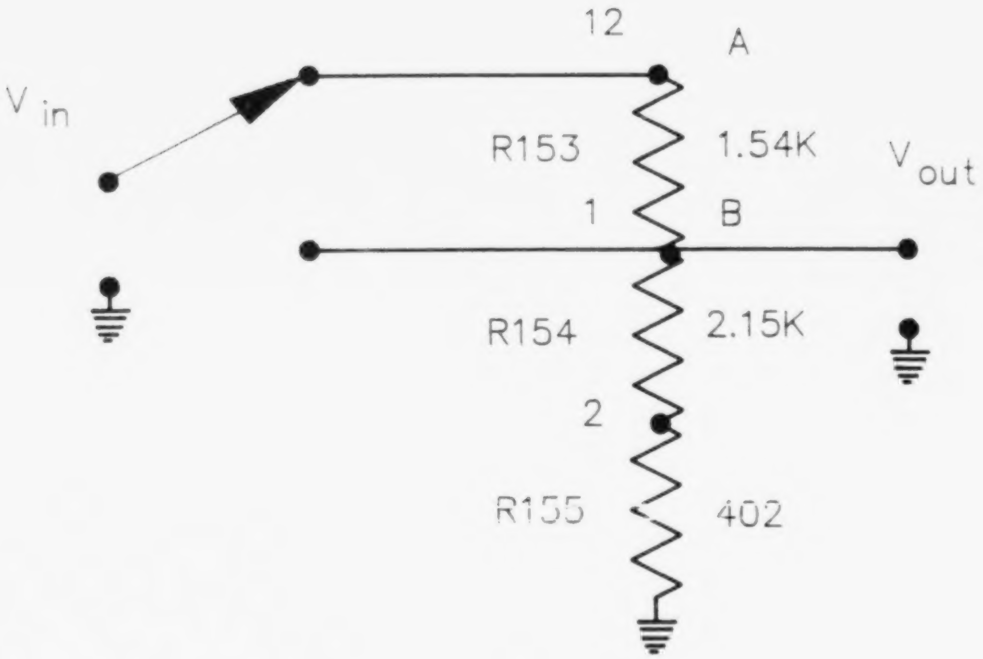

12
A
V in
R153
1.54K
V out
1
B
R154
2.15K
2
R155
402

Figure 2-9. 4-dB Attenuator, Simplified Schematic Diagram

2.3.3.4 Buffer/Driver.- This function is made up of U26, U27, and parts of U28. The LORAN-C signal is applied to the input of the left-most element of U27; the noise signal goes to the left-most element of U26. They are mixed in U28 before the composite signal is applied to buffer/driver U29.

2.3.3.5 Simulator Serial Interface.- Serial interface functions are performed by the custom LORAN device, U6 (CLD). Input data to the Simulator is applied through pin 27 of J2, to pin 74 of the CLD. Data is output from the Simulator at pin 67 of the CLD, to pin 28 of connector J2.

2.3.4 LORAN-C Processor Detailed Theory.- For this theory of operation discussion, reference the LORAN-C Processor Detailed Block Diagram and Logic Diagram in Section 11. The logic diagram is partitioned into nine sections which perform all the functions of the Monitor Processor. The following listing shows the nine sections.

1. CPU
2. Watchdog timer/clock generator
3. Nonvolatile memory
4. System configuration and front panel indicators
5. Address decoding/chip enable generation
6. External communication
7. Internal communication
8. Interrupt control
9. Display

2.3.4.1 CPU.- The CPU consists of the 80C88 Microprocessor, a 16 kbyte by 8-bit block of RAM which is used as scratchpad memory, an 80 kbyte by 8-bit block of ROM which is used as program memory, an address/databus demultiplexer, and a dual wait state generator. Each of these components is described in detail in this section.

The microprocessor (U1) is a CMOS 80C88 type microprocessor with a 16-bit internal architecture and an 8-bit external architecture. This mixed architecture provides the computing abilities, speed, and powerful instruction set of a 16-bit system with the simplicity of an 8-bit system.

The microprocessor is capable of running at 5 MHz, allowing the execution of approximately 100,000 instructions per second.

The 8088 is designed so that the 8-bit databus and the lower 8 bits of the addressbus share the same output pins. This is done by time-multiplexing the data and address outputs. Upon beginning the execution of the machine cycle such as a memory access, the lower 8 bits of the address appear on pins 9 through 16 of the 8088 first and are held there for a period of time, then 8 bits of data appear on the same pins. In order to provide the ability to keep the lower 8 bits of the address valid throughout the machine cycle, it is necessary to latch the address bits before the data bits replace them on the pins. To accomplish this, the ALE (Address Latch Enable) signal is provided by the microprocessor to indicate when the address bits are in a valid state.

This signal is used to control the latching function of a 54LS573 Octal Latch (U2). At the falling edge of ALE, the 54LS573 latches the address bits and holds them in a valid state on the addressbus throughout the machine cycle.

The 16-kbyte RAM memory space, which resides on the board, is to be used as scratchpad memory. The RAM lies in a 32-kbyte block of the memory space of the microprocessor beginning at address 00000H, but is decoded through the use of address bit A12 to be two contiguous 8 kbyte blocks of memory. No actual memory resides in the upper 16-kbytes of the allotted 32-kbyte block. The upper 16-kbyte block is not decoded. The devices used to provide the scratchpad memory are 8-kbyte by 8-bit static CMOS RAMs located in Positions U6 and U7.

The ROM resides in the uppermost 64-kbyte section of the address space of the microprocessor and is decoded as two contiguous 32-kbyte blocks of memory. Additional ROM may be provided by using the expansion slots in the CPU board.

The ROM will contain the operating system and the system-specific code required to provide the specified functionality of the LORAN-C Monitor. The devices used to provide the storage for the program are 27256 EPROMs, U3 and U5, which are 32-kbyte by 8-bit devices.

The Wait State Generator injects "wait states" into the cycle, in order to accommodate slow devices.

The speed of the microprocessor is such that some of the devices which are accessed are not capable of reacting quickly enough to provide proper operation of the system. The devices which fall into this category are the display and the nonvolatile memory devices.

The wait-state generator senses the access of either of these devices and causes the microprocessor to slow down temporarily in order to allow the device being accessed to react properly.

This is accomplished in a similar manner for both types of slow devices by sensing the chip enable associated with each device. Since the nonvolatile memory has eight chip enables associated with it, a 54LS08 two-input AND gate (U15) is used to provide a single indication of nonvolatile chip enable to the wait-state generator when U28, which generates all of the eight chip enables, is activated.

The chip enable signals are sensed through the use of a 54LS74 dual "D" flip-flop (U19). Each flip-flop is dedicated to a slow device.

When a chip enable signal becomes active, it causes a low level to be applied to the corresponding D input of its associated flip-flop. It also removes the reset signal to the 14024 Counter, U17, allowing it to count upon application of a clock signal. This low level is clocked through to the Q output of the flip-flop by the ALE signal via the inverter (U14) and is applied to its corresponding RDY input on the 82C84 and guarantees that the signal is applied during the proper period in the machine cycle.

The level is also used to gate the clock signal to the 14024 Counter, causing it to count.

The 82C84 device, by virtue of its internal design, applies a "not ready" signal to the microprocessor while guaranteeing the proper timing requirements.

The microprocessor reacts by executing "wait-states" during which time the slow device is reacting to the control signals which have been applied by the microprocessor.

When the counter has counted the appropriate number of clock pulses, the output corresponding to the active flip-flop goes to a high level, which "presets" the flip-flop (U19) causing the Q output to go to a high level.

This stops the clock signal to the counter (U17) and places a high level on the corresponding RDY input of the 82C84. The 82C84 then removes the "not ready signal to the microprocessor and the slow device access is ended. The chip enable returns to an inactive state, resetting the counter.

The required number of pulses counted by the counter is determined at the design stage and is dependent on the number of wait-states required by the slow device being accessed. The nonvolatile memory devices require at least two wait-states, while the display requires at least six wait-states.

The operation of the wait-state generator is completely transparent to the software and has very little effect on the speed at which the program is executed.

2.3.4.2 Watchdog Timer and Clock Generator Circuits.- The Watchdog Timer and Clock Generator circuits create the master timing signals for the Monitor Processor.

The 82C84 provides a crystal oscillator and several dividers which are designed to generate the required clock frequencies and duty cycles for the 8088 Microprocessor.

A 15 MHz crystal (Y1) provides the primary frequency which is divided by three to generate the 5 MHz system clock frequency at pin 8.

The 82C84 provides the two wait-state request inputs, pins 4 and 6, referred to in the wait-state generator description.

A system reset input is also provided by the 82C84 on pin 11 The system reset input is a Schmitt trigger input allowing the use of an R-C network for generation of a power-up reset.

The capacitor (C1) causes the reset input to remain low during power-up. This holds the system reset output of the device active and prevents the 8088 from running. As C1 charges through R2, the voltage level on the reset input slowly rises. When the voltage level passes through the Schmitt trigger threshold, the system reset is removed by the 82C84 and the microprocessor is allowed to run normally. The power-on reset feature guarantees that the power supply voltage will have time to reach its required level before the system is allowed to run.

A manual reset button is provided on the board which, when pressed, discharges C1 and places a low level on the reset input of the 82C84, resetting the system.

The watchdog timer resets the microprocessor after a period of approximately 100 ms if the microprocessor does not reset the watchdog timer within that period of time. Since the microprocessor is required to reset the watchdog timer by virtue of the program which it is executing, the assumption that the microprocessor is not executing properly is allowable if the watchdog timer is not reset.

A power transient, static discharge, or other externally applied phenomena may cause the microprocessor to execute improperly. The purpose of the watchdog timer is to cause the microprocessor to recover from the following two situations:

- o When the program is not being executed in its intended manner,
- o When there is no catastrophic failure of the hardware.

The watchdog timer comprises the two 14020 counters, U10 and U11.

The clock input to the timers is the baud rate clock generated by the internal communications controller, U34. The 2.4576 MHz frequency is divided by 2 to the 14th power by U10, which outputs a frequency of 150 Hz on pin 3 to the clock input of U11, pin 10. U11 then divides the 150 Hz signal by 2 to the 5th power, outputting a frequency of 4.69 Hz at pin 5.

The period of this signal is approximately 213 ms. The counter output is low for the first half of this period and high for the other half. Since the high level resets the system, the watchdog timer must be reset by the microprocessor within the first 106 ms of the period.

The watchdog timer is reset by causing the microprocessor to toggle a bit in the output port of the system configuration and I/O circuits which is connected to pin 5 of the OR gate (U12). When the bit is taken high, the output of the OR gates goes high, resetting the counter. The counter is also reset at power-up and during manual reset by the 82C84 (U13), via pin 4 of the OR gate (U12). Resetting the counters forces all outputs to a logical low state.

A means for disabling the watchdog timer is provided by using DIP switch SW2-2 to apply a reset signal to the counter. This inhibits the counters and forces all outputs low, preventing a reset by the watchdog timer.

A 10-ms clock is provided by dividing the 300 Hz output of U10, pin 2 by three through the use of the 14018 divide-by-N counter (U9). U9 is configured as a divide-by-3 counter per its data sheet using the AND gate (U8). The resulting 100 Hz clock signal provides a rising edge every 10-ms, which generates an interrupt to the 8088. See Appendix C for the timing diagram.

The 10-ms clock is used as an interrupt input to the system and provides a time base for the operating system and real-time clock.

2.3.4.3 Nonvolatile Memory.- The nonvolatile memory block is comprised of eight board-edge connectors, P9 through P16, each of which is designed to accept a memory module consisting of three 8-kbyte EEPROM devices. All necessary bus and control signals are provided to the modules through the connectors, including the decoded chip selects.

The EEPROM devices provide read/write capability and nonvolatility without the use of backup batteries and the associated switchover circuitry.

The address space to which the nonvolatile memory is assigned begins at 40000H and ends at 7FFFFH, allowing 256 kbytes of fully decoded address space.

By filling eight card edge connectors, P9 through P16, with fully populated nonvolatile memory modules, the system requirement of 192 kbytes of nonvolatile memory is available.

The nonvolatile memory address space may be increased to 512 kbytes by using different nonvolatile memory boards populated with two 32-kbyte devices.

Optional expansion of the nonvolatile memory is discussed in the Address Decoding Configuration section.

P17 and P18 are expansion connectors to be used for future upgrades. These connectors contain all address, data, and control signals necessary for implementing additional functionality. Several unused chip enables are also available on these connectors. P17 is currently used to expand program memory.

2.3.4.4 System Configuration and Front Panel Indicator Circuits.- The system configuration and front panel indicator circuits comprise two 54LS244 octal buffers (U18 and U20); a 54ALS573 octal buffer (U22); and an eight-position DIP switch (A1S2).

Bits 1 and 2 of U18 are dedicated to background diagnostic functions tested periodically by the microprocessor. Their functions are as follows:

Bit 1: Low level indicates that the battery is low and may require service.

Bit 2: Low level indicates that either the 5-V or the 15-V supply is lower than 96% of its nominal value.

Bits 3 through 8 of U18 in combination with Switches 3 through 8 of the DIP switch are used in the configuration of the system by reading the DIP switch setting via input port U18. When a switch is open, the pull-up resistor in RP1, which is associated with that switch, causes a logical high to be present at the bit of U18 associated with that switch. Closing the switch grounds the input and causes a logical low to be present at the bit.

The port is read when the chip enable, CE5, is active (low) and the RD (read) signal is asserted by the 8088. The resulting logical low at the output of the OR gate (U12) is applied to the output control of U18, causing the outputs to reflect the logical states of the inputs, and placing the data on the databus. The data is interpreted by the 8088 and the necessary initialization or system configuration is performed.

The functions assigned by the software to each of the switches of A1S2 are listed below:

A1S2-1: Select 32 kbyte or 64 kbyte nonvolatile memory blocks
On = 32 kbyte blocks

A1S2-2: Enable/disable watchdog timer. ON =enable

A1S2-3: Enable/disable automatic alarm recovery. ON = enable

A1S2-4: Enable/disable IOT security. ON = enable

A1S2-5: Low order bit of IOT baud rate select

A1S2-6: High order bit of IOT baud rate select

A1S2-6	A1S2-5	Baud Rate
On	On	300
On	Off	1200
Off	On	2400
Off	Off	TBD

A1S2-7: "ON" indicates that the system is connected to an FCPU
A1S2-8: "OFF" enables automatic monitor certification on power-up or when a Recycle Command, L1, is issued.

The front panel indicators are driven by the output port comprised of U22, a 54ALS573 octal latch.

A data byte is written to U22 by asserting a WR (write) signal while the chip enable (CE5) is active. The resulting signal from the OR gate (U12) is applied to the latch input of U22, pin 11. When the latch input is high, the outputs of the device follow the inputs. When the latch input is taken low, the outputs are latched and remain in that logic state until the latch input is taken high again.

The outputs of U22 are used to drive the various front panel indicators and control some on-board functions:

BIT 0:	Selects communication with either the receiver or the simulator
BIT 1:	Resets the watchdog timer
BIT 2:	Not used
BIT 3:	Controls power on/off to the simulator
BIT 4:	Drives Signal ACQUISITION indicator
BIT 5:	Drives Signal TRACKING indicator
BIT 6:	Drives ALARM indicator
BIT 7:	Drives NORMAL indicator

Bits 3 through 7 are used with 2N2222A Transistors to increase the current control capacity of U22.

U20 is used as a buffer for signals which go off the CPU board in order to provide protection against inadvertent shorts or other potentially harmful occurrences.

2.3.4.5 Address Decoding and Chip Enable Circuits.- The address decoding and chip enable circuits comprise U21, U25-U30, and U35-U38.

The highest order four address bits are multiplexed with bus status and must be demultiplexed in the same manner as the address/databus in the CPU section. The bits are demultiplexed by U21, which latches the bits at the falling edge of the ALE signal.

The 1-mbyte address space of the 80C88 Microprocessor is broken into 32 blocks of 32 kbytes each by the address decoding circuitry. This is accomplished by decoding the upper five address bits: A15; A16; A17; A18; and A19. For chip enable assignments and addresses, see Appendix B.

In order to sense the 32-kbyte boundaries, A15 is used as the lowest order decoded bit. A15 will change states each time a 32-kbyte boundary is crossed.

By using A15, A16, and A17 as inputs to the 54LS138 Decoders, U26, U27, and U28, 24 of the 32-kbyte boundaries are detected, and a chip enable is generated for each one. A18 and A19 are used to enable only one of the decoders at a time, preventing more than one chip enable from being activated at once.

Address bits A18 and A19 are decoded to select these devices as follows:

A19	A18	Selected
0	0	U26
0	1	U28
1	0	None
1	1	U27

U28 is used to decode the memory space allotted for the nonvolatile memory. The nonvolatile memory consists of 8-kbyte devices, requiring the 32-kbyte decoded blocks to be subdivided further in order to provide a chip enable for each 8-kbyte device within the 32-kbyte blocks.

This is accomplished by using U35 through U38, dual 2-to-4 decoders, to decode address bits A13 and A14. A13 will change states on each 8-kbyte boundary.

The eight chip enables from U28 are used to select which 2-to-4 decoder is active. The active decoder generates a chip enable for each 8-kbyte block within a 32-kbyte boundary, thus accommodating the 8-kbyte block within a 32-kbyte boundary, thus accommodating the 8-kbyte nonvolatile devices. These 8-kbyte chip enables are present on the card-edge connectors to be used for the nonvolatile memory.

A 256-kbyte block of memory space has been reserved for the nonvolatile memory. However, for future expansion, another 256-kbyte block of unused memory space has also been reserved, starting at 80000H and ending at BFFFFH.

U25 and U30 are data selectors which allow the expansion of the nonvolatile memory by allowing different address bits to be decoded. When the select inputs of the devices are taken low by setting DIP switch 1 to the "on" position, it allows the signals at the "A" inputs to propagate through to the outputs, thus applying address bits A15, A16, and A17 to U28, and A13 and A14 to U30. This causes the nonvolatile memory to be decoded into eight 32-kbyte blocks, which are then subdivided into four 8-kbyte blocks.

Switching DIP switch 1 to the "off" position applies a high level to the select inputs, allowing the signals on the "B" inputs to propagate through to the outputs. This causes A16, A17, and A19 to be applied to U28 and A15 to be applied to U30. In this configuration, the nonvolatile memory space is a 512-kbyte block, which is divided into eight 64-kbyte blocks. These 64-kbyte blocks are subdivided into two 32-kbyte blocks to accommodate the popular 32-kbyte memory devices.

In either configuration, the nonvolatile memory is decoded into contiguous blocks with no undecoded or ambiguous areas.

2.3.4.6 External Communication.- The external communications circuits consist of two 82C52 communication controllers (U31 and U32) and EIA-RS-232 drivers and receivers (U39 and U40).

U31 is dedicated to control of the communication with the FCPU, while U32 is dedicated to control of the communication with the IOT.

The clock signal used by the devices for baud rate generation is generated by U34, a device of the same type but dedicated to internal communication.

Each device is capable of full-duplex, interrupt-driven communication at any standard baud rate. Baud rate selection is independent for each device and is programmed at the time of initialization of the devices.

Each device allows the selection of the format used for data transmission such as number of stop bits, number of data bits, parity, etc.

Each device generates an interrupt to the microprocessor upon receiving a complete byte serially from the outside source. Each device generates an interrupt to the microprocessor upon completing the serial transmission of a byte to the external device, indicating that another byte may be loaded into the transmit buffer for transmission.

The EIA-RS-232 Drivers provide the level switching function necessary to convert the TTL level output of the communication controllers to the levels specified by EIA-RS-232.

The EIA-RS-232 receivers provide the level switching function for converting the EIA-RS-232 levels to TTL levels.

The external interface connectors are configured such that the LORAN-C Monitor will operate as Data Communications Equipment (DCE).

2.3.4.7 Internal Communication.- The internal communication circuits consist of an 82C52 communication controller (U34) and a 54LS157 data selector (U41).

The communication controller is dedicated to control of the internal communication with the LORAN-C receiver and simulator. Since the simulator and receiver will never require communication at the same time, only one controller is necessary.

The data selector is used to control the source and destination of the transmitted and received data. When a low level is applied to the select input of the device, the data at the "A" inputs is allowed to propagate through to the outputs. When a high level is applied, the "B" inputs are selected as the source of data. The inputs are connected such that the "transmitted data" and "received data" pins of the inactive port are held in a "mark" state.

The level of the select pin is controlled via the output port in the System Configuration and Front Panel Indicator circuits. A high level on the select pin allows communication with the simulator. A low level allows communication with the receiver.

2.3.4.8 Interrupt Control.- The interrupt control circuits consist of the 82C59 interrupt controller (U24).

This device provides eight-edge triggered interrupts, which are assigned to the following functions:

1. 10-ms clock
2. Received data, receiver and simulator
3. Transmit data, receiver and simulator
4. Received data, IOT
5. Transmit data, IOT
6. Received data, FCPU
7. Transmit data, FCPU
8. Display advance

2.3.4.9 Display.- The display circuits consist of the 54LS245 bidirectional buffer (U23) and the 54LS74 "D" flip-flop (U16).

The buffer provides protection for the CPU board from shorts or other inadvertent off-board occurrences which could cause damage to the unit.

The DT/R signal from the 8088 is applied to pin 1 of the buffer for control of the direction. DT/R is low during a read, causing the buffer to drive in the B to A direction. DT/R is high during a write, causing the buffer to drive from A to B.

The display chip enable is used to enable the output of the buffer. The chip enable signal is applied to pin 19. An active low level enables the outputs. The chip enable signal also gates the "E" signal at pin 10 of the AND gate (U8) and generates the "enable" signal to the display.

The "E" signal at pin 10 of the AND gate (U8) which clocks the data into or out of the display is generated by U17 in the CPU circuits. All other signals are bus control and data signals from the microprocessor.

The "D" flip-flop (U16) debounces the input of the display advance pushbutton on the front panel. The pushbutton is a single-pole, double-throw switch which connects one of two terminals to ground when it is pressed, and the other of the two when it is released. The normally open terminal is connected to the preset input, pin 4, and the normally closed terminal is connected to the clear input, pin 1, of the flip-flop.

When the button is pressed, the normally open contact is closed, causing the preset input to be pulled to ground and presetting the flip-flop. This causes a rising edge to be applied to Interrupt 7, generating an interrupt to the 8088, which is programmed to advance the display to the next page when servicing this interrupt. When the button is released, the flip-flop is cleared and Interrupt 7 goes to the inactive low state.

Since the flip-flop is preset or cleared on the first application of the low level, the contact bounce of the pushbutton is ignored and the switch is debounced.

2.3.5 Power Supply/Battery Pack Detailed Theory.- Reference the Power Supply/ Battery Pack Schematic Diagram in Section 11.

2.3.5.1 Power Supply.- The LORAN Monitor power supply generates +5 and +/- 15 VDC from a 120 VAC input. The supply is comprised of the following circuits:

- o AC input and rectifier/filter
- o DC-DC converter(s)
- o Battery charger
- o Voltage monitoring comparators

The AC Input and Rectifier Filter circuits provide the AC source voltage and filtering of the rectified DC.

The power supply is connected to 120 VAC at pins 1, 2, and 3 of J2. A metal oxide varistor provides surge protection. The 120 VAC hot and neutral are connected to the primary of the 60 VA step-down transformer through pins 4 and 5 of J2. The primary provides 24 VAC rms and is connected through pins 6 and 7 of J2 to a full-wave bridge rectifier (D4, D5, D6, and D7). The rectifier output is filtered (C1 and C2) and is connected to the Vin terminal of the DC-DC converter.

The DC-DC converter (U3) is a Rifa Mod. PKA2232 25 watt self-contained module. It accepts a DC input in the range of 19 to 35 VDC and provides regulated +5 and +/-15 VDC outputs. A second converter (U4) can be installed in parallel with U3 to provide an additional 25 watts output. The switching frequency is in excess of 300 kHz.

The battery charger circuit is based on a Unitrode Mod. UC2906 lead-acid battery charger IC (U1). In this application, it is programmed to charge a 24 V, 0.45AH battery set. Resistors R4, R5, and R6 determine the overcharge and float charge voltage levels. The overcharge voltage is set at 29.9 V (2.5 V/cell) while the float charge is set at 27.6 V (2.3 V/cell). The charger IC provides temperature compensation (-3.9 mv/deg C) in the overcharge and float charge modes.

When the battery has been sufficiently discharged, the charger will go into the bulk charge mode. In this state, the circuit is programmed to charge the battery at approximately a C/10 or 50 mA rate. The current sampling resistor samples the charging current in the bulk charge state. Transistor Q2 controls the current and voltage charging levels.

Four independent comparators are used to monitor critical voltage levels of the power supply. The four comparators are implemented using a single LM139 quad comparator with open collector NPN ground referenced transistor outputs. A 6.4 V Zener diode (D3), and associated resistive divider, provides a stable reference for all the comparators.

The two comparators on the left side of the schematic monitor the +5 and +15 supply outputs and signal the CPU if either of these voltages fall below a preset level. The top-left comparator's output will transition from high to low when the +15V supply drops below 14.4V. The bottom-left comparator output will go low when the +5V supply drops below 4.8 V. These comparator outputs are WIRED-OR outputs. Therefore, the CPU cannot distinguish between them.

The comparators on the right side of the schematic monitor the input voltage to the DC-DC converter. The lower right comparator output will go low when the input voltage drops below 21 V. The upper right comparator is used to disconnect the battery from the system to prevent excessive discharge.

2.3.5.2 Battery Pack.- The battery is normally connected to the system through relay K1 when AC power is present at the rectifier bridge. The upper right comparator's output transistor will be turned on, energizing the relay coil. When the AC power fails, the relay remains energized because the battery is still supplying power to the system and the voltage is still above the comparator threshold. As the battery discharges, its output voltage drops until the cutoff threshold is reached and the comparator's output transistor turns off and de-energizes the relay, disconnecting it from the system.

2.3.6 Antenna Coupler Detailed Theory.- Figure 2-10 shows the interconnections between the Antenna Coupler, the Cable Driver, the Simulator, the Receiver, and the Monitor Processor. Refer also to the Antenna Coupler Schematic Diagram in Section 11. Table 2-1 shows the signals monitored at the test points in the Antenna Coupler.

Table 2-1. Antenna Coupler Test Points

Test Point	Signal or Function
E1	Input signal from antenna
E2	Ground
E3	Input RF signal and relay control from Simulator
E4	Ground to shield of simulator coax
E5, E6	"Twin-Ax" output to Cable Driver

Relay SW1 is shown normally de-energized.

The antenna matching circuits comprise the R-C network R1,R2-C1,C2, transistors Q1, Q2, and their support devices. The bandpass filter and preamp are made up of transistors Q3 through Q8.

During normal operation, the input signal is applied through terminals 18 and 20 of relay SW1 to the bandpass filter/preamp. During test operations, the system software caures a control signal to be applied to SW1-22 to energize the relay and switch input from the antenna to the simulator. This simulator signal is applied through SW1-14 and SW1-16 to the bandpass filter/preamp.

The Preamp output appears across secondary terminals F3,S2 of transformer T1. This signal is carried over "twin-ax" to the LORAN-C Monitor, where it is applied to input terminals S2,F3, of transformer T1 of the Cable Driver module. The Cable Driver module is also called the Antenna Coupler Power Supply.

Cable Driver Detailed Theory.- Refer to the Cable Driver Schematic Diagram in Section 11. The Cable Driver module performs three functions: it couples signals from the Antenna Coupler to the Receiver; it derives the 12.5 VDC operating voltage for the Antenna Coupler from the Monitor Processor 15 VDC power supply; and it decouples the Monitor Processor 15 VDC power supply from the RF signal variations from the Antenna Coupler. Operation is straightforward.

The RF Signal from the Antenna Coupler is coupled by transformer T1 to the Receiver BNC connector connected across secondary terminals S1,F1. The DC operating voltage for the Antenna Coupler is derived from the 15 VDC which is applied at terminal E5 from connector J19 of the Monitor Processor. Resistors R3,R2,R5,R6, and R7 form a voltage divider which applies approximately 12.2 VDC at the center tap F2,S3 of the primary of transformer T1. This voltage provides operating power to the Antenna Coupler. It is routed over the same twin-ax cable that carries the RF signal from the Antenna Coupler to the Cable Driver. Transistors Q1,Q2, and Q3 form a series regulator to clamp the voltage to approximately 12.2 V, while resistors R1,R2 and Capacitors C1,C2,C3,C4,C5, and C6 perform the necessary filtering action.

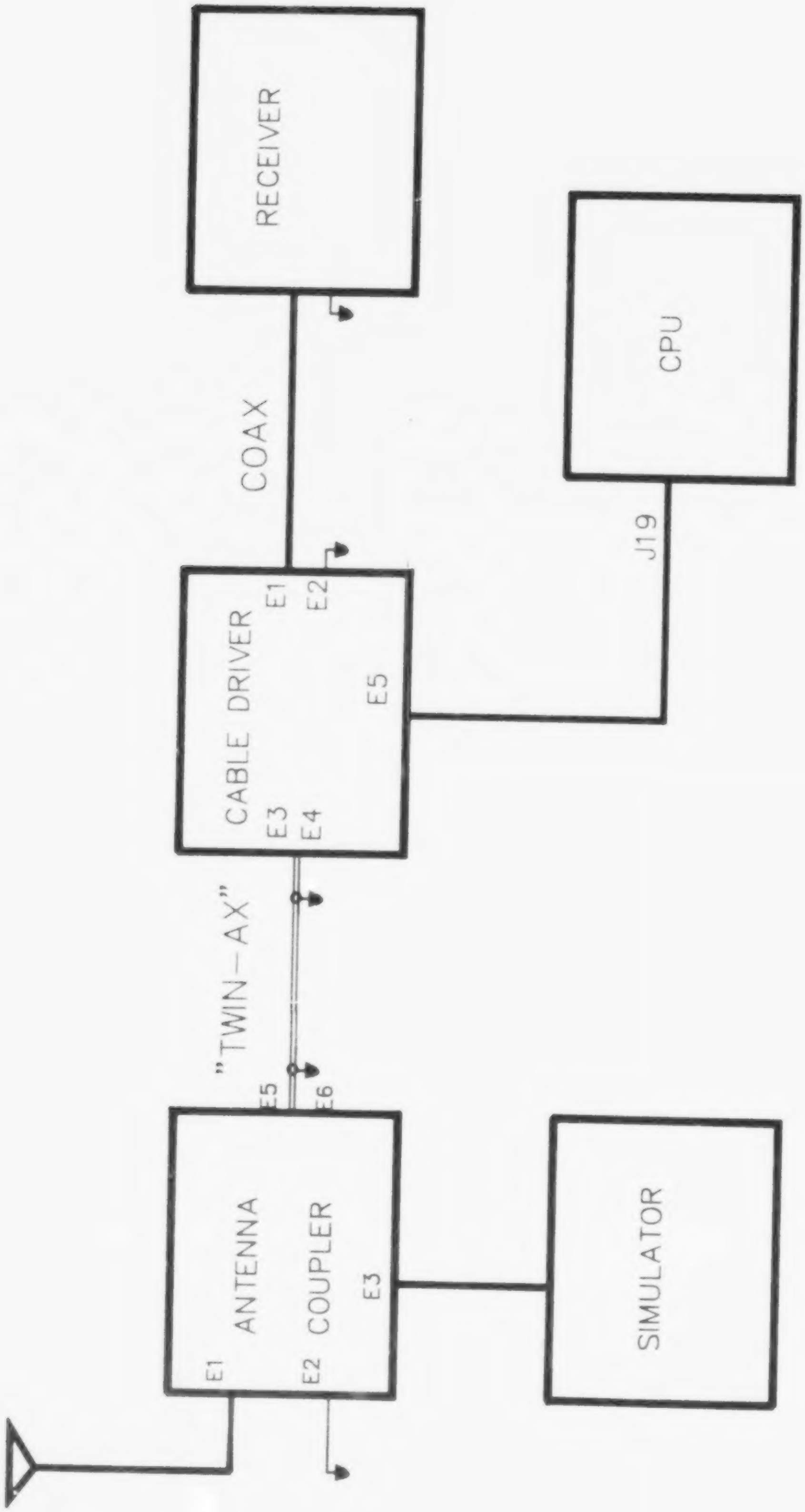

RECEIVER
COAX
CPU
J19
CABLE DRIVER
E1
E2
E3
E4
E5
"TWIN-AX"
E5
E6
ANTENNA
COUPLER
E1
E2
E3
SIMULATOR

Figure 2-10. Antenna Coupler Interconnections

SECTION 3 - OPERATION

3.1 INTRODUCTION.- This section contains operation instructions for the LORAN-C Monitor System. All physical controls and indicators are illustrated and described. An example and description of operator screens is provided to familiarize operational personnel with the procedures for requesting various system parameters and operational status of the contents of the screens as displayed on local terminals. Procedures are provided for turning on the equipment, for a shutdown state, and for turning off the equipment.

3.2 CONTROLS/INDICATORS.- The front panel controls and indicators are illustrated in figure 3-1 and listed in Table 3-1. figure 3-2 shows the rear panel connectors.

3.3 TURN ON/CHECKOUT.- Turn on and checkout procedures are presented in Table 3-2.

3.4 SYSTEM SHUTDOWN AND RESET CONTROL.- Use the following procedure to shut down the system:

a. LOGOFF - if monitor is in security mode.
b. Turn POWER switch to OFF.

3.5 REMOTE MONITORING AND CONTROL OVERVIEW.- This section lists the Remote Monitoring and Control functions and, where applicable, directs you to the paragraph where the operations are presented. Some of these functions are not applicable to the LORAN-C Monitor; others are presented in other sections of this instruction book. In those cases, you are directed to the appropriate section from here.

3.5.1 Fault Detection and Isolation.- Fault Detection and Isolation procedures are presented in Section 7.

3.5.2 Automatic Ground Check and Analysis.- This procedure is not applicable to the LORAN-C Monitor System.

3.5.3 Programmable Certification Parameter Counter.- This procedure is not applicable to the LORAN-C Monitor System.

3.5.4 Certification Testing.- Certification Testing is presented in Section 6, paragraph 6.2.

3.5.5 Monitor Integrity Testing.- The integrity of the LORAN-C Monitor is determined by the results of the LORAN-C Monitor Self-Test (refer to paragraph 6.2.1), LORAN-C Monitor Test (refer to paragraph 7.2.2), and the Certification Test (refer to paragraph 6.2.2).

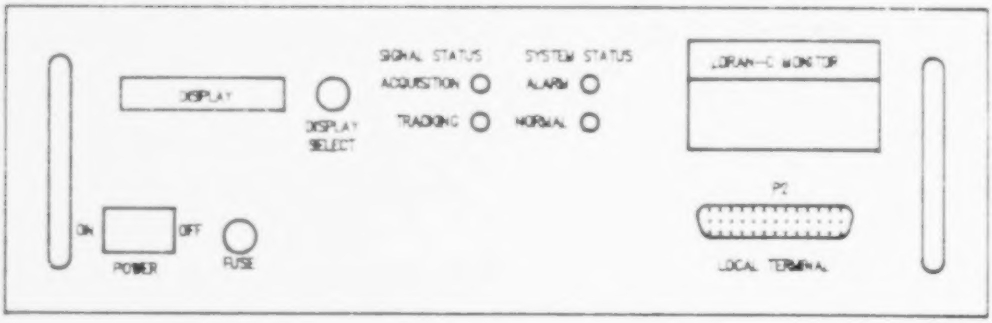

DISPLAY
DISPLAY SELECT
SIGNAL STATUS
ACQUISITION
TRACKING
SYSTEM STATUS
ALARM
NORMAL
LORAN-C MONITOR
P2
LOCAL TERMINAL
ON
OFF
POWER
FUSE

Figure 3-1. Front Panel Controls and Indicators

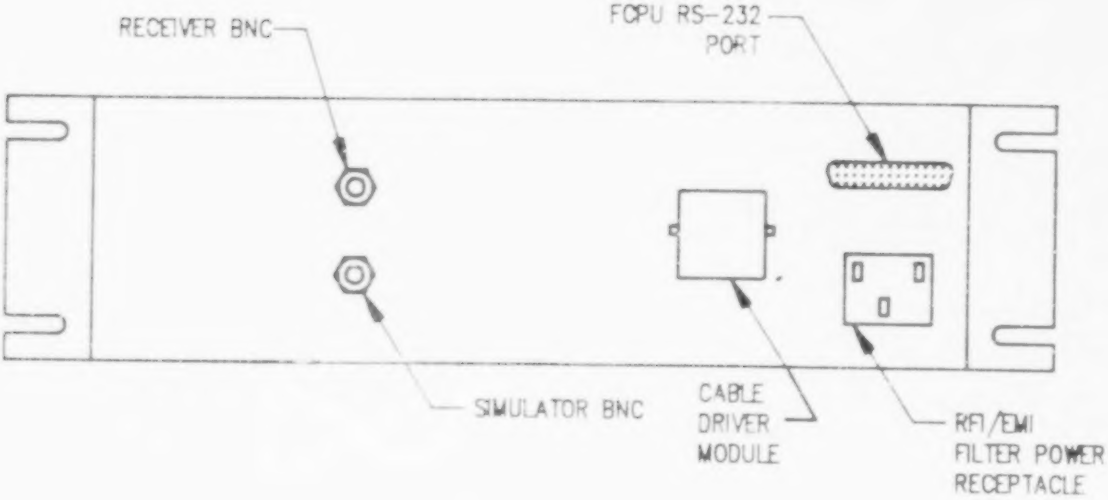

RECEIVER BNC
FCPU RS-232 PORT
SIMULATOR BNC
CABLE DRIVER MODULE
RFI/EMI FILTER POWER RECEPTACLE

Figure 3-2. Rear Panel

Table 3-1. Controls and Indicators

Control or Indicator	Ref Des	Function
POWER ON-OFF	S1	Provides AC power to monitor when placed in ON position. Illuminates when POWER switch is in the ON position (amber).
FUSES AC FUSE	F1	Single 2-A fuse in nominal 120 VAC line.
FUSE HOLDER	XF	Standard Fuse Holder.
PARAMETER LIQUID CRYSTAL DISPLAY	DS1	Displays the signal parameter values of the Executive Data File. Display has two lines with 24 characters in each. The top line indicates the parameter. The bottom line indicates the value of that parameter.
DISPLAY SELECT SWITCH	S2	When the DISPLAY SELECT SWITCH is pressed, a different executive data parameter value is shown.
SIGNAL STATUS ACQUISITION LED	DS2	Indicates that the receiver is attempting to acquire LORAN signals (yellow).
TRACKING LED	DS3	Indicates that the receiver has locked onto the LORAN signal and is tracking (yellow).
SYSTEM STATUS ALARM LED	DS4	Indicates that one of the Executive Data Parameters has exceeded the alarm limit in 7 of the last 10 samples, or a blink condition has persisted for 12 seconds (red).
NORMAL LED	DS5	Indicates that all Executive Data Parameters are within the alarm limits (green).

Table 3-2. Turn on/Checkout Procedures

LOCATION	ITEM	ACTION	INDICATION-REMARKS
1. Front Panel	Power On-Off Rocker Switch	Switch to "ON" position	Power Switch Illuminates. If not, check AC plug, check fuse, check bulb in power switch.
2. IOT Screen	Password entry request Operator ID prompt Day/Date prompt	Enter correct sequence	Main menu appears on IOT after password(s), operator ID, and date/time entry.
3. Front Panel	Signal Acquisition Status Indicator	Observe	Indicator will illuminate after entry of item 2. If not, check operating parameters. Perform "Clear archives and install defaults" (J12), if necessary.*
4. Front Panel	Signal Tracking Status Indicator	Observe	Indicator will illuminate if system is able to acquire a signal. Signal acquisition status indicator will be extinguished when tracking indicator is illuminated. If tracking indicator does not illuminate within 15 minutes after the acquisition indicator illuminates, check operation parameters for valid GRI and secondaries, check cables to antenna coupler, check coupler connections, check antenna.
5. Front Panel	Normal Status Indicator	Observe	Green normal status indicator will illuminate at same time as tracking indicator.
6. Front Panel	Alarm Status Indicator	Observe after 2 Min of Tracking Indicator	Red alarm status indicator will illuminate and green normal status indicator will extinguish if an executive alarm condition exists. Display executive parameters ("B" screen) to determine which parameter is out of tolerance. Alarm limit values (J2 screen) may be adjusted to eliminate alarm condition.

Table 3-2. Turn on/Checkout Procedures (cont.)

LOCATION	ITEM	ACTION	INDICATION-REMARKS
7. IOT Screen	"B" Screen Parameters	Display "B" screen on IOT	Observe the "Self-Test Results" entry, line #1. An indication of "Good" ensures that no hardware faults have been detected by the diagnostics. If "Bad" is indicated, display the "Fault Isolate Results" (I14) to determine the cause of the problem. Perform "Fault Isolate" (K4), if required.

*This will destroy all archived data - use with caution.
*Enter Current Date (YY/MM/DD) and Time (HH:MM:SS) via Monitor IOT,if no FCPU is connected.

3.5.6 Security Management. Security is the responsibility of two separate entities--the VORTAC System and the LORAN-C Monitor. Local security is optional, and is enabled or disabled by switch (A1S2-6) located on the Monitor Central Processor Unit (MCPU).

3.5.6.1 Security furnished by the VORTAC System provides security of the Facility Central Processing Unit (FCPU). The FCPU is located inside a building which is secured under provisions of the VORTAC facility security plan.

3.5.6.2 Security of the LORAN-C Monitor Input/Output Terminal is managed by the LORAN-C Monitor programming. At initialization, the Security Processing Unit writes the security menu (refer to figure 3-8) to the local terminal. The operator may select one of the options.

3.5.6.3 The following three levels of security are provided:

a. PASSWORD status - operator has access to copy or view all data.

b. LOCKOUT status - operator is permitted to copy or view all data and make adjustments to noncritical parameters (i.e., those parameters not associated with certification parameters or monitor alarm threshold parameters).

c. SAFEGUARD status - permits operator to have access to copy or view data and to adjust any controls, including those associated with certification parameters or alarm threshold. The operator is also permitted to change the security keys. Additionally, at this level of access, the last day/time tagging and operator identification is stored and accompanies all certification data. Operator ID is required upon entry of safeguard password(s).

3.5.7 Password Procedures. All Password procedures are controlled from the Security Directory, shown in figure 3-8. These procedures are presented in paragraph 3.6.7.

3.5.8 Communication Control.- The LORAN-C Monitor is enslaved to the FCPU in terms of communication. The interface between the FCPU and the LORAN-C Monitor consists of a digital serial data interface (RS-232-C). The interface provides the FCPU the capability to issue commands to the LORAN-C Monitor. It also provides a means for the Monitor to indicate to the FCPU when the Monitor has completed the commands. The interface also provides the capability for the FCPU to transfer file data to/from the LORAN-C Monitor. This data represents information required for monitor operation (i.e., data contains monitor alarm limits, time of day, LORAN-C Monitor certification setup parameters, etc.). The interface provides the capability for the FCPU to read files stored in the monitor. These files may be produced as a normal monitor function (i.e., the current LORAN-C signal in space data may be produced as a part of a monitor command, or may be produced by an FCPU file write).

3.6 OPERATOR INTERFACE FOR THE LORAN-C MONITOR SYSTEM.- The following subparagraphs provide a detailed description of the operation interface for the LORAN-C Monitor System. The operator interface is implemented at the local terminal. Commands and data are sent to and received from the local terminal. The interface interprets commands from the local terminal and starts the applicable task or subroutine to execute the command. All commands require the implementation of one of the levels of security before they can be entered and accepted (refer to figure 3-8).

Input to the local terminal interface consists of commands received from the local terminal or data files requested by the local terminal. When the operator enters a command at the local terminal, the interface receives and validates the command. The applicable task or subroutine to execute the command is then started. After receiving a command from the local terminal, the operator interface outputs the command and its parameters to the applicable task or subroutine. It then executes the command. If the local terminal has requested data, the data requested shall be output to the local terminal.

3.6.1 Screens and Command Structure.- Figure 3-3 shows the organization of the screens and command structure for the LORAN-C Monitor. The screens are presented in figures 3-4 through 3-25. All operations begin with the LORAN DIRECTORY. The LORAN DIRECTORY displays the top-level functions available to the operator. Table 3-3 gives an overview of the command structure.

A LORAN DIRECTORY
B MONITOR EXEC DATA
C ALARM HISTORY
D MONITOR CERT DATA
I MAINTENANCE DATA DIRECTORY

  14 LORAN FAULT ISOLATE
  15 LORAN MON TEST RESULTS
  16 LORAN 10-MINUTE AVERAGES
  17 LORAN 4-HOUR AVERAGES
  18 LORAN BLINK DATA
  19 LORAN 1-SECOND ALARM DATA
  20 LORAN 1-MINUTE ALARM DATA

J PARAMETER SETUP DIRECTORY

  1 OPERATING PARAMETERS
  2 MONITOR ALARM LIMITS
  5 CERT GEN SETUP
  9 LORAN MON TEST GEN SETUP
  10 FUTURE TD CORRECTION VALUES
  11 SET TIME AND DATE
  12 CLEAR ARCHIVES & INSTALL DEFAULTS

K COMMANDS RUN TESTS

  1 ABORT TEST
  2 CERT TEST
  3 TEST LORAN MON
  4 FAULT ISOLATE
L COMMANDS MAINTENANCE
  1 RECYCLE
  2 RESET

S SECURITY DIRECTORY
  1 LOGON PASSWORD LEVEL
  2 LOGON LOCKOUT LEVEL
  3 LOGON SAFEGUARD LEVEL
  4 CHANGE SECURITY KEYS
  5 LOGOFF MONITOR
  6 RETURN TO LORAN DIRECTORY

Figure 3-3. Screens and Command Structure

Table 3-3. Command Structure Overview

Screen Entries	Meaning
MONITOR EXEC DATA	Enter B - Press RETURN. The MONITOR EXEC DATA screen will appear. This screen displays the current state of all LORAN executive parameters. Note: An asterisk indicates that the corresponding parameter has exceeded the alarm limit.
FILED	Indicates date and time of filing.
SELF-TEST RESULTS	Indicates the results of the LORAN Monitor's self-test. The data field will display one of the following:
GOOD	Indicates the LORAN MONITOR TEST and/or background diagnostics detected no critical monitor failures.
*BAD	Indicates the LORAN MONITOR TEST and/or background diagnostics detect a fault which may prevent proper operation of the monitor.
CERT RESULTS	Indicates the result of the LORAN MONITOR'S CERTIFICATION TEST. The data filed will display one of the following:
GOOD	Indicates the LORAN MONITOR CERTIFICATION TEST has been successfully completed.
*BAD	Indicates the LORAN MONITOR CERTIFICATION TEST was unsuccessful.
CERT ACTIVE	Indicates that the LORAN MONITOR is prevented from measuring the signal in space due to the activity of the certification process. It will have one of the following values:
*YES	Indicates that the certification process is active and the signal in space is not currently being monitored.
NO	Indicates that the certification process is not active.

Table 3-3. Command Structure Overview (cont.)

Screen Entries	Meaning
MONITOR TEST ACTIVE	Indicates that the LORAN Monitor is prevented from measuring the signal in space due to the activity of the LORAN Monitor Test Process. It will have one of the following values:
*YES	Indicates that the monitor test process is active and the signal in space is not currently being monitored.
NO	Indicates that the LORAN Monitor Test Process is not active.
MASTER SNR, SEC1 SNR, SEC2 SNR	The DATA Column displays the current value of the Signal-to-Noise Ratio (SNR) in decibels (dB) from each station. Signal-to-noise ratio data are displayed as decibel numbers from - 15 to +22 inclusive. The displayed resolution is 1 dB.
MASTER ECD SEC1 ECD, SEC2 ECD	The data column displays the current value of the envelope-to-cycle difference (ECD) in usec for each station. Envelope to cycle difference data is displayed as decimal numbers from - 4.0 to 4.0 inclusive. The displayed resolution is 0.1 usec.
SEC1 BLINK, SEC2 BLINK	Indicates the presence or absence of BLINK occurrence. The data column will display one of the following:
ABSENT	Indicates the associated station is not currently blinking.
*PRESENT	Indicates the station is currently blinking.
OFFSET	Indicates the difference in NM between the calculated position and surveyed position.
PRESS RETURN TO CONTINUE	Pressing RETURN will return the operator to the LORAN DIRECTORY screen.
C ALARM HISTORY	ENTER C-PRESS RETURN. The LORAN ALARM HISTORY screen displays the executive data which were present at the time of the three most recent executive alarms. The parameter(s) which caused each alarm will be flagged with an asterisk.

Table 3-3. Command Structure Overview (cont.)

Screen Entries	Meaning
FIRST TWO LINES	Indicates year, month, and day on which the associated alarm history was filed. The time is in 24-hour format (HH:MM:SS)(e.g., 14:30:26 indicates 30 minutes, 26 seconds, past 2 p.m.)
	Note: The data displayed in columns 1,2, and 3 are in the same form and content as the data displayed in the LORAN MONITOR EXEC DATA screen.
DATA COLUMN 1	This left-most column displays the executive data of the earliest of the three alarms.
DATA COLUMN 2	The middle column displays the executive data at the time of the alarm that occurred after the alarm of the first column.
DATA COLUMN 3	This right-most column displays the executive data at the time of the most recent alarm.
PRESS RETURN TO CONTINUE	Pressing RETURN will return the operator to the LORAN DIRECTORY screen.
D MONITOR CERT DATA ENTER	D - Press RETURN. The LORAN MON CERT DATA screen displays the values measured by the LORAN Monitor when the signal from the LORAN test signal generator is applied to the LORAN Monitor System. This file is created upon execution of the LORAN certification command. Operator ID is also displayed.
	Note: The LORAN signal generator programmable parameters are set to those indicated in the LORAN certification setup screen.
FILED	Indicates date and time of filing.
SET DATA COLUMN	This column contains the LORAN signal generator setup parameters given on the LORAN signal generator setup screen, (J5).
MEAS-DATA COLUMN	This column contains the results of the measurements which were performed by the monitor during the certification test.
PRESS RETURN TO CONTINUE	Pressing RETURN will return the operator to the LORAN DIRECTORY screen.

Table 3-3. Command Structure Overview (cont.)

Screen Entries	Meaning
1 MAINTENANCE DATA DIRECTORY	Enter 1 - press RETURN. The MAINTENANCE DATA DIRECTORY screen displays maintenance files that can be selected by the operator.
14 LORAN FAULT ISOLATE RESULTS	Enter 14 - Press RETURN. The LORAN FAULT ISOLATE screen displays the results of the monitor fault isolation function and background diagnostics results.
FILED	Indicates date and time of filing.
PRESS RETURN TO CONTINUE	Pressing RETURN will return the operator to the LORAN DIRECTORY screen.
15 LORAN MON TEST RESULTS	Enter 15 - Press RETURN. The LORAN MONITOR TEST DATA screen displays the results of the monitor test.
FILED	Indicates date and time of filing.
SEC1 BLINK, SEC2 BLINK	Data column 1 indicates whether the occurrence of blink was detected by the LORAN Monitor when measuring the LORAN test signal generator with the signal generator set for blink. It will display one of the following:
GOOD	Indicates blink was detected when blink was present.
*BAD	Indicates blink was not detected when blink was present.
	Data column 2 indicates whether the occurrence of blink was detected by the LORAN Monitor when measuring the LORAN test signal generator signal with the signal generator set for no blink. One of the following will be displayed:
GOOD	Indicates no blink was detected when no blink was present.
*BAD	Indicates blink was detected when no blink was present.

Table 3-3. Command Structure Overview (cont.)

Screen Entries	Meaning
LOW LIMIT DATA COLUMNS 1 & 2	These columns contain the monitor's measured values of SNR and ECD and time difference taken during the monitor test. For data in column 1, the signal generator setup was calculated by subtracting the associated offset in screen J9 from the associated LOW alarm limit for each parameter. For data in column 2, the signal generator setup was calculated by adding the associated offset to the associated LOW alarm limit. The measured data in data column 1 should be less than the LOW executive alarm limit; for data in data column 2 it should be greater than the LOW executive alarm limit. Data preceded by an outside asterisk indicates a failed monitor test.
HIGH LIMIT DATA COLUMN 3 & 4	These columns contain the monitor's measured values of time difference and ECD during certification testing. For data in column 3, the value was calculated by adding the associated offset to the associated executive HIGH alarm limit. For data in column 4, the value was calculated by subtracting the associated offset from the associated executive HIGH alarm limit. Note: For the LORAN-C Monitor to pass the monitor test, the measured data in data column 3 should be greater than the HIGH executive alarm limit; for data in data column 4 it should be less than the HIGH executive alarm limit. Data preceded by an asterisk indicates a failed monitor test.
PRESS RETURN TO CONTINUE	Pressing RETURN will return the operator to the LORAN DIRECTORY screen.
16 LORAN 10 MINUTE AVERAGES	Enter 16 - Press RETURN. The LORAN Monitor Archived Data Prompt Line will appear. This will precede the display of any of the LORAN MONITOR archived data (10-MINUTE AVERAGES, 4-HOUR DATA, BLINK DATA, 1-SECOND ALARM DATA, and 1-MINUTE ALARM DATA).

Table 3-3. Command Structure Overview (cont.)

Screen Entries	Meaning
ENTER YY/DD/MM HH:MM:SS, NO. OF RECORDS <0 FOR ALL>	Enter a date and time which specifies the beginning point for displaying the 10-minute averaged data archive. Note: A date and time specification of 00/00/00 00:00:00 (or simply "0") indicates that the operator wants the entire contents of the file, beginning with the earliest entry in the buffer. Number of records may range from 0 to 32766. If a zero (0) is entered, it indicates that all records filed on or after the date specified are to be printed.

Note: Maximum number of records available for each file is as follows:

ONE SECOND ALARM DATA - 100 with 120 subrecords per record

ONE MINUTE ALARM DATA - 100 with 20 subrecords per record

BLINK TIME DATA - 100

FOUR HOUR AVERAGE DATA - 360

	After entering appropriate data, press RETURN. The LORAN 10-MINUTE AVERAGE screen will appear. The screen displays data associated with the 10-minute average archive data file. Each record is composed of the average, over the previous 10 minutes, of SNR, ECD, and TD data.
FILED	Indicates date and time of filing. This is the time and date at which the first record displayed was filed. Subsequent records will have been filed every 10 minutes thereafter.

Table 3-3. Command Structure Overview (cont.)

Screen Entries	Meaning
<ENTER ^C TO STOP>	Prompt, informing operator that the data dump can be stopped by holding the CONTROL key down and pressing C.
SNRM	Data below this header displays SNR of the master station.
ECDM, ECD1, ECD2	Data below these headers displays the value of ECD for the master, secondary, and secondary 2, respectively.
TD1	Data below this header displays the secondary 1 time difference.
SNR1	Data below this header displays the SNR of the secondary 1 station.
TD2	Data below this heading displays the secondary 2 time difference.
SNR2	Data below this header displays the SNR of the secondary 2 station.
END OF FILE	Will be displayed when no more successive records are available.
PRESS RETURN TO CONTINUE	Pressing RETURN will return the operator to the LORAN DIRECTORY screen.
17 LORAN 4-HOUR DATA	Enter 17 - Press RETURN. The LORAN 4-HOUR DATA Menu will appear. This will precede the display of any of the LORAN MONITOR archived data (10-MINUTE AVERAGES, 4-HOUR DATA, BLINK DATA, 1-SECOND ALARM DATA, and 1-MINUTE ALARM DATA).
ENTER YY/DD/MM HH:MM:SS, NO. OF RECORDS <0 FOR ALL>	Enter a date and time which specifies the beginning point for displaying the 4-hour averaged data archive. Note: A date and time specification of 00/00/00 00:00:00 (or simply "0") indicates that the operator wants the entire contents of the file, beginning with the earliest entry in the buffer.

Table 3-3. Command Structure Overview (cont.)

Screen Entries	Meaning
FILED	Indicates date and time of filing.
<ENTER ^C TO STOP>	Prompt, informing operator that the data dump can be stopped by holding the CONTROL key down and pressing C.
SNRM	Data below this header displays SNR of the master station.
ECDM, ECD1, ECD2	Data below these headers displays the value of ECD for the master, secondary, and secondary 2 stations, respectively.
TD1	Data below this header displays the secondary 1 time difference.
SNR1	Data below this header displays the SNR of the secondary 1 station.
TD2	Data below this header displays the secondary 2 time difference.
SNR2	Data below this header displays the SNR of the secondary 2 station.
END OF FILE	Will be displayed when no more successive records are available.
PRESS RETURN TO CONTINUE	Pressing RETURN will return the operator to the LORAN DIRECTORY screen.
18 LORAN BLINK DATA	Enter 18. Press RETURN. The LORAN BLINK DATA Menu will appear. This will precede the display of any of the LORAN MONITOR archived data (10-MINUTE AVERAGES, 4-HOUR DATA, BLINK DATA, 1-SECOND ALARM DATA, and 1-MINUTE ALARM DATA).
ENTER YY/DD/MM HH:MM:SS, NO. OF RECORDS <0 FOR ALL>	Enter a date and time which specifies the beginning point for displaying the blink data archive. Note: A date and time specification of 00/00/00 00:00:00 (or simply "0") indicates that the operator wants the entire contents of the file, beginning with the earliest entry in the buffer.

Table 3-3. Command Structure Overview (cont.)

Screen Entries	Meaning
<ENTER ^C TO STOP>	Prompt informing operator the data dump can be stopped by holding the CONTROL key down and pressing C. Note: Headers are printed only once per operator request. Subsequent records are printed without headers.
ON	Data below this header displays the date and time at which blink began.
OFF	Data below this header displays the date and time at which blink ended.
SEC	Data below this line displays the following:
1	Indicates that secondary 1 station was blinking.
2	Indicates that secondary 2 station was blinking.
END OF FILE	Will be displayed when no more successive records are available.
PRESS RETURN TO CONTINUE	Pressing RETURN will return the operator to the LORAN DIRECTORY screen.
19 LORAN 1-SECOND ALARM	Enter 19 - Press RETURN. The LORAN 1-SECOND ALARM DATA screen will appear. This will precede the display of any of the LORAN MONITOR archived data (10-MINUTE AVERAGES, 4-HOUR DATA, BLINK DATA, 1-SECOND ALARM DATA, and 1-MINUTE ALARM DATA).
ENTER YY/DD/MM HH:MM:SS, NO. OF RECORDS <0 FOR ALL>	Enter a date and time which specifies the beginning point for displaying the 1-second data archive. Note: A date and time specification of 00/00/00 00:00:00 (or simply "0") indicates that the operator wants the entire contents of the file, beginning with the earliest entry in the buffer. Note: This data file contains data associated with up to 100 previous alarms. Upon detection of an alarm condition, the 1-second averaging buffer, containing 120 records (each representing 1 second of executive data), will have been archived.

Table 3-3. Command Structure Overview (cont.)

Screen Entries	Meaning
<ENTER ^C TO STOP>	Prompt, informing operator that the data dump can be stopped by holding the CONTROL key down and pressing C.
DATE & TIME LINE	Indicates the date and time (under headers) associated with the record immediately following. This will be printed as required to clearly define the times associated with any following records.
SNRM	Data below this header displays SNR of the master station.
ECDM, ECD1, ECD2	Data below this header displays the ECD of the master, secondary 1, and secondary 2 stations, respectively.
TD1	Data below this header displays the secondary 1 time difference.
SNR1	Data below this header displays the SNR of the secondary 1 station.
TD2	Data below this heading displays the secondary time difference.
SNR2	Data below this header displays the SNR of the secondary 2 station.
END OF FILE	Will be displayed when no more successive records are available.
PRESS RETURN TO CONTINUE	Pressing RETURN will return the operator to the LORAN DIRECTORY screen.
20 LORAN MONITOR 1-MINUTE ALARM DATA	Enter 20 - Press RETURN. The LORAN 1-MINUTE ALARM DATA screen will appear. This will precede the display of any of the LORAN MONITOR archived data (10-MINUTE AVERAGES, 4-HOUR DATA, BLINK DATA, 1-SECOND ALARM DATA, and 1-MINUTE ALARM DATA).
ENTER YY/DD/MM HH:MM:SS, NO. OF RECORDS <0 FOR ALL>	Enter a date and time which specifies the beginning point for displaying the 1-minute averaged data archive.

Table 3-3. Command Structure Overview (cont.)

Screen Entries	Meaning
	Note: A date and time specification of 00/00/00 00:00:00 (or simply "0") indicates that the operator wants the entire contents of the file, beginning with the earliest entry in the buffer. Note: This data file contains data associated with up to 100 previous alarms. Upon detection of an alarm condition, the 1-minute averaging buffer, containing 20 records (each representing 1-minute of executive data), will have been archived.
FILED	Indicates date and time of filing.
<ENTER C TO STOP>	Prompt, informing operator that the data dump can be stopped by holding the control key down and pressing C.
SNRM	Data below this header displays SNR of the master station.
ECDM, ECD1, ECD2	Data below these headers displays the value of ECD for the master, secondary 1, and secondary 2 stations, respectively.
TD1	Data below this header displays the secondary 1 time difference.
SNR1	Data below this header displays the SNR of the secondary 1 station.
TD2	Data below this header displays the secondary 2 time difference.
SNR2	Data below this header displays the SNR of the secondary 2 station.
END OF FILE	Will be displayed when no more successive records are available.
PRESS RETURN TO CONTINUE	Pressing RETURN will return the operator to the LORAN DIRECTORY screen.

3.6.2 Detailed Screen and Command Descriptions.- The following subparagraphs present the individual screens of the command structure, along with a brief explanation of each.

```
-----------------------------------------------------------------*
A   LORAN DIRECTORY
B   MONITOR EXEC DATA
C   ALARM HISTORY
D   MONITOR CERT DATA
I   MAINTENANCE DATA DIRECTORY
J   PARAMETER SETUP DIRECTORY
K   COMMANDS RUN TESTS
L   COMMANDS MAINTENANCE
S   SECURITY DIRECTORY


------------------------------------------------------------------
```

Figure 3-4. A LORAN Directory Screen

LORAN functions are accessed by entering:

x, <CR>

Where x is B, C, D, I, J, K, L, or S; and CR is the carriage return character.

3.6.4 LORAN Monitor Executive Data Screen.- The LORAN MONITOR EXEC DATA screen displays the current state of all LORAN executive parameters.

```
--------------------------------------------------------------*
B  M O N I T O R  E X E C  D A T A            FILED     note 9
                                  data

SELF TEST RESULTS              note 1
CERT RESULT                    note 2
CERT ACTIVE                    note 3
MON TEST ACTIVE                note 8
MASTER SNR                     note 5         DB
MASTER ECD                     note 6         USEC
SEC 1 BLINK                    note 7
SEC 1 SNR                      note 5         DB
SEC 1 ECD                      note 6         USEC
SEC 2 BLINK                    note 7
SEC 2 SNR                      note 5         DB
SEC 2 ECD                      note 6         USEC
OFFSET                         note 10
---------------------------------------------------------------
```

Figure 3-5. B Monitor Exec. Data Screen

The possible values of each of the displayed parameters are described in notes 1 through 10.

Note 1 - SELF-TEST RESULTS - Indicates the results of the LORAN Monitor's self-test and the results of the background diagnostics which run continuously. The DATA field displays one of the following:

GOOD - Indicates the LORAN Monitor self test successfully completed and no critical monitor failures were detected. Also indicates that no faults have been detected by the background diagnostics.

*BAD - Indicates the LORAN Monitor self test was unsuccessful or a fault has been detected by the background diagnostics. To discover the source of the failure, display the MON TEST RESULTS screen (I15) and the FAULT ISOLATE RESULTS screen (I14).

Note 2 - CERT RESULT - Indicates the results of the LORAN Monitor's certification test. The DATA field will display one of the following:

GOOD - Indicates the LORAN Monitor certification test has been successfully completed.

*BAD - Indicates the LORAN Monitor certification test was unsuccessful.

Note 3 - CERT ACTIVE - This parameter indicates whether the LORAN Monitor is in the process of performing a certification test.

*YES - Indicating that the certification process is active and the signal in space is not currently being monitored.

NO - Indicating that the certification process is not active.

Note 4 - Not used.

Note 5 - MASTER SNR, SEC 1 SNR, SEC 2 SNR - The DATA column displays the current value of the signal-to-noise ratio in decibels (dB) from each station. Signal to noise ratio data are displayed as decimal numbers from -15 to 22 inclusive. The displayed resolution is one dB. If the datum is beyond the associated alarm limit, then it is preceded by an asterisk (*).

Note 6 - MASTER ECD, SEC 1 ECD, SEC 2 ECD - The DATA column displays the current value of the envelope-to-cycle difference in usec for each station. Envelope to cycle difference data are displayed as decimal numbers from -4.0 to 4.0 inclusive. If the ECD exceeds +/- 4.0, usec then -5 usec is displayed. The displayed resolution is 0.1 usec. If the datum is beyond the associated alarm limits, then the datum will be preceded by an asterisk (*).

Note 7 - SEC 1 BLINK, SEC 2 BLINK - Indicates the presence or absence of BLINK occurrence. The DATA column displays one of the following:

ABSENT - Indicates the associated station is not currently blinking.

*PRESENT - Indicates the station is currently blinking.

Note 9 - MON TEST ACTIVE - This parameter will indicate the LORAN Monitor is prevented from measuring the signal in space due to the activity of the LORAN Monitor test process. It will have one of two values:

*YES - Indicating that the monitor test process is active and the signal in space is not currently being monitored.

NO - Indicating that the monitor test process is not active.

Note 10 - This field displays the time and date of filing.

Note 11 - This field displays the difference between the surveyed position and the calculated position in NM.

3.6.5 LORAN Monitor Recent Alarm History Screen.- The LORAN ALARM HISTORY screen displays the executive data which was present at the time of the three most recent executive alarms.

```
----------------------------------------------------------------*
C  L O R A N  A L A R M  H I S T O R Y
                       note 5    note 5     note 5
                       note 6    note 6     note 6
SELF TEST RESULT       note 1    note 2     note 3
CERT RESULT            note 1    note 2     note 3
CERT ACTIVE            note 1    note 2     note 3
MON TEST ACTIVE        note 1    note 2     note 3
MASTER SNR             note 1    note 2     note 3        DB
MASTER ECD             note 1    note 2     note 3        USEC
SEC 1 BLINK            note 1    note 2     note 3
SEC 1 SNR              note 1    note 2     note 3        DB
SEC 1 ECD              note 1    note 2     note 3        USEC
SEC 2 BLINK            note 1    note 2     note 3
SEC 2 SNR              note 1    note 2     note 3        DB
SEC 2 ECD              note 1    note 2     note 3        USEC
OFFSET

-----------------------------------------------------------------
```

Figure 3-6. C LORAN Alarm History Screen

Note 1 - This column displays the executive data of the earliest of the three alarm histories. The form and content of each of the data is the same as that described for the DATA column in the LORAN Monitor executive data screen.

Note 2 - This column displays the executive data at the time of the alarm that occurred after the alarm of the first column. The form and content of each of the data is the same as that described for the DATA column in the LORAN Monitor executive data screen.

Note 3 - This column displays the executive data at the time of the most recent alarm. The form and content of each of the data is the same as that described for the DATA column in the LORAN Monitor executive data screen.

Note 5 - This data contains the year, month, and day and gives the date on which the associated alarm history was filed.

Note 6 - This column displays the time of filing. The time is in 24-hour format and is of the form HH:MM:SS (e.g., 14:30:26 indicates 30 minutes and 26 seconds past 2:00 p.m.).

3.6.6. Monitor Certification Data Screen.- The LORAN MON CERT DATA screen gives the values measured by the LORAN Monitor when the signal from the LORAN test signal generator is applied to the monitor system.

```
-----------------------------------------------------------------*
D   M O N   C E R T   D A T A                        FILED    note 2

                    SET          MEAS
MASTER SNR          note 3       note 4       DB
MASTER ECD          note 3       note 4       USEC
SEC 1 SNR           note 3       note 4       DB
SEC 1 ECD           note 3       note 4       USEC
SEC 2 SNR           note 3       note 4       DB
SEC 2 ECD           note 3       note 4       USEC
OFFSET
OPERATOR ID         note 5
-----------------------------------------------------------------
```

Figure 3-7. D Monitor Cert Data Screen

This file is updated upon completion of the LORAN Monitor certification command. The LORAN signal generator programmable parameters are set to those indicated in the LORAN certification setup screen, J5.

Note 1 - not used.

Note 2 - This field displays the time and date of filing.

Note 3 - This column contains the LORAN certification signal generator setup parameters given on the LORAN signal generator setup screen, J5.

Note 4 - This column contains the results of the measurements. The format for data display is the same as that described for the executive data screen, except no asterisks are displayed.

Note 5 - The initials of the operator who performed the last certification appear here, if the IOT Security is enabled.

3.6.7 Security Directory Screen.- The SECURITY DIRECTORY screen presents the operator with six options. These options include selecting the security level; changing the security keys; logging off the monitor; and returning to the LORAN-C Monitor main directory.

```
S   S E C U R I T Y
 1 LOGON PASSWORD LEVEL
 2 LOGON LOCKOUT LEVEL
 3 LOGON SAFEGUARD LEVEL
 4 CHANGE SECURITY KEYS
 5 LOGOFF MONITOR
 6 RETURN TO LORAN DIRECTORY
```

Figure 3-8. S Monitor Security Directory Screen

The SECURITY DIRECTORY screen allows any of three levels of security to be invoked from the keyboard. These are: Password Level, Lockout Level, Safeguard Level, in that order. For an operator to do anything whatsoever, he must have the lowest level which is Password. A brief summary of these options is presented here. See paragraph 3.7 for a full description of security operations.

1. LOGON PASSWORD LEVEL

The user may have any of three levels of security assigned: Password Level, Lockout Level; or Safeguard Level; in that order, with Password being the lowest level of security available. The highest level of security is Safeguard level.

2. LOGON LOCKOUT LEVEL

To gain Lockout level access, the operator must have first gained access to Password. Then the operator selects 2 from the Security Directory by pressing 2 and then pressing RETURN. Lockout level lets the operator change system certification parameters.

3. LOGON SAFEGUARD LEVEL

To gain Safeguard level access, the operator must have first gained access to Password and Lockout levels. Then the operator selects 3 from the Security Directory by pressing 3 and then pressing RETURN. Once the operator is granted Safeguard level access, he has the highest level of security available. That means he can perform all operations that are permitted from a local terminal. The operator is prompted for the entry of the operator ID when access at the safeguard level is granted.

4. CHANGE SECURITY KEYS

The operator must have Safeguard Level access before being able to use option 4 to change any of the Security keys.

5. LOGOFF MONITOR

Option 5 permits the operator to leave the system operating unattended without the danger of someone without proper security level accessing sensitive data or performing unauthorized operations. Effectively, the Logoff Monitor command negates the system access which is gained by successively entering each password level. Although when logged off no action may be performed at the IOT, the acquired signal parameters may be viewed via the front panel LCD.

6. RETURN TO LORAN DIRECTORY

To return to the main directory, the operator presses 6 and then presses RETURN.

3.6.8 Maintenance Data Directory Screen.- The Maintenance Data Directory has seven subdirectories. These subdirectories are described in the following seven paragraphs.

```
---- -------------------------------------------------------*
I   M A I N T E N A N C E   D A T A   D I R E C T O R Y
14 LORAN FAULT ISOLATE
15 LORAN MON TEST
16 LORAN 10 MINUTE DATA
17 LORAN 4 HOUR DATA
18 LORAN BLINK DATA
19 LORAN 1 SECOND ALARM DATA
20 LORAN 1 MINUTE ALARM DATA

------------------------------------------------------------
```

Figure 3-9. I Maintenance Data Directory Screen

The MAINTENANCE DATA DIRECTORY screen displays maintenance files that can be selected for display by the operator. The operator may select and display any of the files by entering the associated line number followed by a carriage return. The LORAN Monitor archived data prompt precedes the display of any of the LORAN Monitor archived data (e.g., 1 SECOND ALARM DATA, 1 MINUTE ALARM DATA, BLINK DATA, 4 HOUR DATA, or 10 MINUTE DATA). This prompt informs the operator to enter a date and time, which will be used to access the file. The operator also enters the number of records to be printed or displayed.

Note 1 - The operator enters a date and time, followed by a comma, followed by a decimal integer indicating the number of records to be printed.

The date and time indicates that the operator wants to begin the display with the first record filed on or after the specified date. A date and time specification of 00/00/00 00:00:00 indicates that the operator wants the entire contents of the file. The date 00/01/01 represents January 1, 2000 and thus precedes 00/12/31.

The number of records may range from 0 to 32767. If the number is 0, then the operator indicates that all records filed on or after the specified date are to be printed. If the number exceeds the number of records filed on or after the specified date, then all such records will be printed. The maximum number of records available from each file is as follows:

ONE SECOND ALARM DATA - 100 with 120 subrecords per record
ONE MINUTE ALARM DATA - 100 with 20 subrecords per record
BLINK TIME DATA - 100
FOUR HOUR AVERAGE DATA - 360
TEN MINUTE DATA - 288

3.6.8.1 I14 FAULT Isolate Screen.- The LORAN FAULT ISOLATE screen displays the results of the monitor fault isolation function and/or the background diagnostics results. If self test results are shown as "bad" on the B screen, I14 will contain background diagnostic results: NO FAULT ISOLATION HAS BEEN PERFORMED.

```
                                                                      *
________________________________________________________________________
I14   L O R A N   F A U L T   I S O L A T E          FILED  note 1
note 2

CPU ROM MODULE FAILED
SIMULATOR MODULE FAILED
LCD MODULE FAILED
LOW BATTERY VOLTAGE
LOW POWER SUPPLY VOLTAGE

PRESS RETURN TO CONTINUE
________________________________________________________________________
```

Figure 3-10. I14 FAULT Isolate Screen

Note 1 - This field displays the time and date of filing.

Note 2 - If there are no LORAN Monitor faults, then this field will display "NONE." The form and content of this field, when monitor faults are detected, are described in the LORAN Monitor detailed design specification. Figure 3-10 shows how each of the failures would be displayed. Note that this is for information purposes only. All possible faults are not shown.

3.6.8.2 I15 Monitor Test Data Screen.- The LORAN MONITOR TEST DATA screen displays the results of the monitor test.

```
-----------------------------------------------------------------*
I15   M O N I T O R   T E S T   D A T A          FILED   note 2

SEC 1 BLINK     A note 9     N note 10
SEC 2 BLINK     A note 9     N note 10

                       LOW LIMIT               HIGH LIMIT

MASTER SNR      A note 5     N note 6                                dB
MASTER ECD      A note 5     N note 6     A note 13      N note 14 USEC
SEC 1 SNR       A note 5     N note 6                                dB
SEC 1 ECD       A note 5     N note 6     A note 13      N note 14 USEC
SEC 2 SNR       A note 5     N note 6                                dB
SEC 2 ECD       A note 5     N note 6     A note 13      N note 14 USEC
OFFSET          A note 7     N note 8                                NM

                       COMP                    DIF

TD1                    Note 11                 Note 12
TD2                    Note 11                 Note 12

-----------------------------------------------------------------
```

Figure 3-11. I15 Monitor Test Data Screen

The displayed form of signal-to-noise ratio and envelope-to-cycle difference is the same as in the executive data screen with the following exceptions:

Note 1 - Not used.

Note 2 - This field displays the time and date of filing.

Note 3 - Not used.

Note 4 - Not used.

Note 5 - These areas display the monitor's measured values of signal-to-noise ratio and envelope-to-cycle difference during the test process. These data fields are measurements, made by the monitor, of the LORAN test signal generator's signal. The signal generator's output parameters are set to signal-to-noise ratios and ECDs determined from the executive alarm limits screen and the Monitor Test Generator setup screen. Specifically, the test generator's setup was calculated by subtracting the associated offset (given in the Monitor Generator setup screen) from the associated LOW alarm limit (given in the executive alarm limits screen). In order for the monitor to pass, each of the measured data which are displayed in this column, should be less than the low executive alarm limit. If this is not the case, then the data will be preceded by an asterisk, indicating a failed test.

I15 LORAN MONITOR TEST DATA SCREEN (cont.)

Note 6 - These data are similar to those of note 5 in that they display the monitor's measured values of the test generator's signal-to-noise, envelope-to-cycle difference, during the Monitor Test process. However, the signal generator's output parameters were set to values determined by adding the associated offset (given in the Monitor Test setup screen) to the associated LOW alarm limit (given in the executive alarm limits screen). In order for the monitor to pass, each of the measured data which are displayed in this column, should be greater than the low executive alarm limit. If this is not the case, then the data will be preceded by an asterisk, indicating a failed Monitor test.

Note 7 - These data show the measured value of position offset with the signal generator set to time difference values calculated for the offset magnitude and direction obtained the associated offset to the alarm limit. The data will be preceded by an asterisk if the measured value is not greater than the executive alarm limit.

Note 8 - This data shows the measured value of position offset with the signal generator set to time difference values calculated by subtracting the offset from the associated executive high alarm limit. The data will be preceded by an asterisk if the measured value is not less than the executive alarm limit.

Note 9 - These data indicate whether the occurrence of blink was detected by the LORAN Monitor when measuring the LORAN test signal generator with the signal generator set for blink. It will have one of the following values:

GOOD - Indicates blink was detected when blink was present.

*BAD - Indicates blink was not detected when blink was present.

Note 10 - These data indicate if the occurrence of blink was detected by the LORAN Monitor when measuring the LORAN test signal generator signal with the signal generator set for no blink. It will have one of the two following values:

GOOD - Indicates blink was not detected when no blink was present.

*BAD - Indicates blink was detected when no blink was present.

Note 11 - These data are the values of Time Difference calculated for a given offset magnitude and direction from the Latitude and Longitude specified in J1.

Note 12 - These are the differences between the Time Differences set up in the Simulator, Note 11, and the measured Time Differences. A difference of 0.02 usec or printer will cause a failure of the test.

Note 13 - These areas display the monitor's measured values of signal-to-noise ratio and envelope-to-cycle difference during the test process. These data fields are measurements, made by the monitor, of the LORAN test signal generator's signal. The signal generator's output parameters are set to signal-to-noise ratios and ECDs determined from the executive alarm limits screen and the Monitor Test Generator setup screen. Specifically, the test generator's setup was calculated by subtracting the associated offset (given in the Monitor Generator setup screen) from the associated HIGH alarm limit (given in the executive alarm limits screen). In order for the monitor to pass, each of the measured data which are displayed in this column, should be less than the high executive alarm limit. If this is not the case, then the data will be preceded by an asterisk, indicating a failed test.

Note 14 - These data are similar to those of note 13 in that they display the monitor's measured values of the test generator's signal-to-noise, envelope-to-cycle difference, during the Monitor Test process. However, the signal generator's output parameters were set to values determined by adding the associated offset (given in the Monitor Test setup screen) to the associated HIGH alarm limit (given in the executive alarm limits screen). In order for the monitor to pass, each of the measured data which are displayed in this column, should be greater than the high executive alarm limit. If this is not the case, then the data will be preceded by an asterisk, indicating a failed Monitor test.

3.6.8.3 I16 10 Minute Average Screen. - The LORAN 10 MINUTE AVERAGE screen display is a screen that displays the data associated with the ten minute average archive data file. This file contains data associated with up to 48 hours worth of signal-to-noise, ECD, and time difference data average: calculated every 10 minutes, of signal-to-noise, ECD, and time difference data.

```
----------------------------------------------------------------*
I16   L O R A N  10  M I N U T E  A V E R A G E

(ENTER ^C TO STOP)
     SNRM     ECDM      TD1      SNR1    ECD1     TD2      SNR2     ECD2     FILED
note 1                note 2   note 3           note 4   note 5            note 6


note 1        note 8  note 2   note 3   note 8 note 4   note 5   note 8   note 6
note 7
-----------------------------------------------------------------
```

Figure 3-12. I16 10-Minute Average Screen

The first and second lines of the display provide a header that displays the name of the file accessed. The third line is a prompt that informs the operator that the data dump can be stopped by holding the control key down while pressing the C key. The fourth line of the display is a header which contains mnemonics that are associated with the data fields of notes 2 through 7. These lines are printed without the headers.

The fields associated with notes 2 through 7 represent one data record.

The form and content for the fields associated with notes 2 through 6 are the same as given for the associated DATA field in the LORAN Monitor executive data screen, except that no asterisks will be printed.

The field length for each datum is exclusive of the single space character which follows every field (refer to notes 1 through 8).

Note 1 - This 5 character wide field displays the signal-to-noise ratio of the master station.

Note 2 - This 9 character wide field displays the secondary 1 time difference.

Note 3 - This 5 character wide field displays the signal-to-noise ratio of the secondary 1 station.

Note 4 - This 9 character wide field displays the secondary 2 time difference.

Note 5 - This 5 character wide field displays the signal-to-noise ratio of the secondary 2 station.

Note 6 - This field contains the date and time of filing associated with the record. This field will be printed once upon initiation of the data dump. When this field is not printed, the data record will be associated with a time that is 10 minutes later than the previous record.

Note 7 - This field will contain END OF FILE when no more successive records are available.

Note 8 - This field displays the value of the ECDs for the master, secondary 1, and secondary 2.

3.6.8.4. <u>I17 4 Hour Data Screen</u>. The LORAN 4-HOUR DATA screen is a screen that displays the data associated with the 4-hour average archive data file. This file contains data associated with up to 60 days' worth of signal-to-noise, ECD, and time-difference data averages, calculated every 4 hours. Each record is composed of the average, over the previous 4 hours, of signal-to-noise, ECD, and time-difference data.

```
----------------------------------------------------------------------*
I17   L O R A N  4  H O U R  D A T A
LORAN MON
(ENTER ^C TO STOP)
  SNRM    ECDM     TD1     SNR1      ECD1     TD2      SNR2     ECD2    FILED
 note 1   note 7  note 2  note 3    note 7  note 4   note 5   note 7  note 6
   .
   .
   .
 note 1   note 7  note 2  note 3    note 7  note 4   note 5   note 7  note 6
 note 8
-----------------------------------------------------------------
```

Figure 3-13. I17 4 Hour Data Screen

The first and second lines of the display provide a header that displays the name of the file accessed. The third line is a prompt that informs the operator that the data dump can be stopped by holding the control key down while pressing the C key. The fourth line of the display is a header, which contains mnemonics that are associated with the data fields of notes 2 through 7. These lines are printed only once per operator request. Subsequent records are printed without the headers.

The fields associated with notes 2 through 7 represent one data record.

The form and content of the fields associated with notes 2 through 6 are the same as given for the associated DATA field in the LORAN MONITOR EXEC DATA screen, except that no asterisks will be printed.

The field length for each datum is exclusive of the single space character which follows every field (refer to notes 1 through 7).

Note 1 - This 5-character wide field displays the signal-to-noise ratio of the master station.

Note 2 - This 9-character wide field displays the secondary 1 time difference.

Note 3 - This 5-character wide field displays the signal-to-noise ratio of the secondary 1 station.

Note 4 - This 9-character wide field displays the secondary 2 time difference.

Note 5 - This 5-character wide field displays the signal-to-noise ratio of the secondary 2 station.

Note 6 - This field contains the date and time of filing associated with the record. This field will be printed once upon initiation of the data dump. When this field is not printed, the data record will be associated with a time that is 4 hours later than the previous record.

Note 7 - This field will contain values for the station's ECD value.

Note 8 - This field will contain END OF FILE when no more records are available.

3.6.8.5. <u>I18</u> <u>Blink</u> <u>Data</u> <u>Screen</u>.- The LORAN BLINK DATA screen is a screen that displays the times at which blink began and blink ended. Up to 100 such records can be accessed.

```
-----------------------------------------------------------------*
I 18   L O R A N   B L I N K   D A T A

LORAN MON

(ENTER ^C TO STOP)
ON                      OFF                 SEC
note 1                  note 2              note 3
   .
   .
   .
note 1                  note 2              note 3
note 4
------------------------------------------------------------------
```

Figure 3-14. I18 Blink Data Screen

The first and second lines of the display provide a header that names the file accessed. The third line is a prompt that informs the operator that the data dump can be stopped by holding the control key down while pressing the C key. The fourth line is a header which contains mnemonics associated with the data fields of notes 1 through 3. These lines are printed only once per operator request. Subsequent records are printed without the headers.

The fields associated with notes 1 through 3 represent one data record.

Note 1 - This field displays the date and time at which blink began.

Note 2 - This field displays the date and time at which blink ended.

Note 3 - This field displays either a 1, to indicate that secondary 1 station was blinking, or 2, to indicate that secondary 2 station was blinking.

Note 4 - This field will contain END OF FILE when no more successive records are available.

3.6.8.6 I19 1 Second Alarm Data Screen.- The LORAN 1 SECOND ALARM DATA screen displays the data associated with the 1-second alarm snapshot archived date file. This file contains data associated with up to 100 previous alarms. For each alarm, 120 records (each representing 1 second) of executive data will have been archived.

```
----------------------------------------------------------------------------*
I19   L O R A N  1  S E C O N D  A L A R M  D A T A   FILED note 1

(ENTER ^C TO STOP)
 SNRM    ECDM    TD1     SNR1    ECD1    TD2     SNR2    ECD2
note 2  note 3  note 4  note 5  note 6  note 7  note 8  note 9
note 2  note 3  note 4  note 5  note 6  note 7  note 8  note 9
   .
   .
   .
note 2  note 3  note 4  note 5  note 6  note 7  note 8  note 9
note 2  note 3  note 4  note 5  note 6  note 7  note 8  note 9
   .
   .
   .
note 11
-----------------------------------------------------------------------------
```

Figure 3-15. I19 1 Second Alarm Data Screen

The first and second lines of the display provide a header that displays the name of the file accessed. The third line is a prompt that informs the operator that the data dump can be stopped by holding the control key down while pressing the C key. The fourth line of the display is a header, which contains mnemonics that are associated with the data fields of notes 2 through 9. These lines are printed only once per operator request. Subsequent records are printed without the headers.

The fields associated with notes 2 through 10 represent one executive data record.

The form and content for the fields associated with notes 2 through 9 are the same as given for the associated DATA field in the LORAN Monitor executive data screen.

The field length for each datum is exclusive of the single space character which follows every field (refer to notes 1 through 11).

I19 1 Second Alarm Data Screen (cont.)

Note 1 - This field contains the date and time associated with the record immediately following. This field will be printed as often as necessary to clearly define the times associated with any of the following records. The second and subsequent executive data records following this field will be associated with a time that is 1 second later than the previous executive data record.

Note 2 - This 5-character wide field displays the signal-to-noise ratio of the master station.

Note 3 - This 8-character wide field displays the envelope-to-cycle difference of the master station.

Note 4 - This 9-character wide field displays the secondary 1 time difference.

Note 5 - This 5-character wide field displays the signal-to-noise ratio of the secondary 1 station.

Note 6 - This 8-character wide field displays the envelope-to-cycle difference of the secondary 1 station.

Note 7 - This 9-character wide field displays the secondary 2 time difference.

Note 8 - This 5-character wide field displays the signal-to-noise ratio of the secondary 2 station.

Note 9 - This 8-character wide field displays the envelope-to-cycle difference of the secondary 2 station.

Note 11 - This field will contain END OF FILE when no more successive records are available.

3.6.8.7 __I20__ __1 Minute Alarm Data Screen__.- The LORAN 1 MINUTE ALARM DATA dump is a screen that displays the data associated with the 1-minute alarm snapshot archive date file. This file contains data associated with up to 100 previous alarms. For each alarm, up to 10 records (each representing a 1-minute average) of signal-to-noise, ECD, and time difference data will have been archived.

```
---------------------------------------------------------------------*
I20   L O R A N  1  M I N U T E  A L A R M  D A T A    FILED note 6

(ENTER ^C TO STOP)
 SNRM    ECDM    TD1     SNR1    ECD1    TD2     SNR2    ECD2
note 1  note 7  note 2  note 3  note 7  note 4  note 5  note 7
   .
   .
   .
note 1          note 2  note 3          note 4  note 5
note 8

---------------------------------------------------------------------
```

Figure 3-16. I20 1 Minute Alarm Data Screen

The first and second lines of the display provide a header that displays the name of the file accessed. The third line is a prompt that informs the operator that the data dump can be stopped by holding the control key down while pressing the C key. The fourth line of the display is a header, which contains mnemonics that are associated with the data fields of notes 2 through 7. These lines are printed only once per operator request. Subsequent records are printed without the headers.

The fields associated with notes 2 through 7 represent one data record.

The form and content for the fields associated with notes 2 through 6 are the same as given for the associated DATA field in the LORAN Monitor executive data screen, except that no asterisk will be printed.

The field length for each datum is exclusive of the single space character which follows every field (refer to notes 1 through 8).

Note 1 - This 5-character wide field displays the signal-to-noise ratio of the master station.

Note 2 - This 9-character wide field displays the secondary 1 time difference.

Note 3 - This 5-character wide field displays the signal-to-noise ratio of the secondary 1 station.

Note 4 - This 9-character wide field displays the secondary 2 time difference.

Note 5 - This 5-character wide field displays the signal-to-noise ratio of the secondary 2 station.

I20 1 Minute Alarm Data Screen (cont.)

Note 6 - This field contains the date and time associated with the record. This field may or may not be present. This field will be printed as often as necessary to clearly define the times associated with any of the following records. When this field is not printed, the data record will be associated with a time that is 1 minute earlier than the previous record.

Note 7 - This field will show values representing the station's ECD value.

Note 8 - This field will contain END OF FILE when no more successive records are available.

3.6.9. <u>Parameter Setup Directory and its Subdirectories</u>.- The Parameter Setup Directory has five subdirectories. The Parameter Setup Directory screen displays the setup files that may be accessed by the operator.

```
-------------------------------------------------------------*
J   P A R A M E T E R   S E T U P   D I R E C T O R Y

 1 OPERATING PARAMETERS
 2 MONITOR ALARM LIMITS
 5 CERT GEN SETUP
 9 LORAN MON TEST GEN SETUP
10 FUTURE TD CORRECTION VALUES
11 SET TIME AND DATE
12 CLEAR ARCHIVES AND INSTALL DEFAULTS


-------------------------------------------------------------
```

Figure 3-17. J Parameter Setup Directory Screen

The operator may select one of the setup screens by typing the associated number and entering a carriage return. The five subdirectories are described in the following five paragraphs.

3.6.9.1 J1 Operating Parameters Screen.- The LORAN MONITOR OPERATING PARAMETERS screen displays the LORAN Monitor site specific data.

```
----------------------------------------------------------------*
J1  O P E R A T I N G  P A R A M E T E R S    FILED   note 1

 1 MONITOR LATITUDE                note 2
 2 MONITOR LONGITUDE               note 2
 3 GRI CODE                        note 4
 4 SECONDARY 1 ID                  note 3
 5 SECONDARY 2 ID                  note 3
 6 SEC 1 TD CORRECTION             note 5
 7 SEC 2 TD CORRECTION             note 5

 Enter new parameter value
 or press RETURN to continue.

-----------------------------------------------------------------
```

Figure 3-18. J1 Operating Parameters Screen

The operator may change any of the parameters by entering:

n, x <CR>

Where n is the line number of the associated parameter, x is the new value of the parameter, and <CR> is the carriage return key. If any parameter is changed, the new operating parameters are loaded into the receiver and the system is reset upon pressing <CR>, taking the system off the air and into acquisition mode. If no parameters are changed, no reset occurs.

Note 1 - This field displays the time and date of filing.

Note 2 - The data defines the coordinates of the surveyed position of the LORAN Monitor. The coordinates are indicated in the following format:

dd mm ss.ss c, Where:

dd - represents degrees. Enter a 1-, 2-, or 3-digit number (entry required).

mm - represents minutes. A two-digit number is required.

ss.ss - represents seconds and hundredths of seconds. The decimal point and 2-digit number on both sides of the decimal point is required.

c - represents the reference direction and will be either N or S, for latitudes or W or E, for longitudes. Spaces are required between each element as indicated. There must be an entry for each element. Some valid examples are as follows:

24 48 03.60 N
143 00 09.00 E
0 22 43.65 N

To change: enter line number followed by a comma <,>, followed by the new value.

Example: 1, 24 48 03.60 N

Note 3 - This data identifies LORAN secondary stations being monitored. The data is indicated in the following format:

a

where "a" is a single, lower or upper case, alphabetic character representing the secondary station identifier. The codes which correspond to the secondaries of some common chains are listed below.

Chain	GRI	Secondaries	Secondary Code
Canadian West Coast	5990	X	A
		Y	B
		Z	C
Gulf of Alaska	7960	X	A
		Y	B
		Z	C
Southeast	7980	W	A
		X	B
		Y	C
		Z	D
Great Lakes	8970	W	A
		X	B
		Y	C
		Z	D
West Coast	9940	W	A
		X	B
		Y	C
		Z	D
North East	9960	W	A
		X	B
		Y	C
		Z	D
North Pacific	9990	X	A
		Y	B
		Z	C

Note 4 - This parameter displays the group repetition interval (GRI) code of the chain to be monitored. The GRI code is displayed as a decimal number with values from 4000 to 9999. The GRI, in usec, is calculated by multiplying the GRI code by 10.

Note 5 - This parameter displays correction factors to be implemented in the coordinate conversion algorithm. Units are in usec, with form factor as follows: X.XX

After making the changes, press <CR> to return to the LORAN-C Monitor main directory.

3.6.9.2 J2 Monitor Alarm Limits Screen.- The current LORAN MONITOR ALARM limits screen displays the current values of all LORAN executive alarm limits associated with each executive parameter.

```
---------------------------------------------------------------*
J2  M O N I T O R  A L A R M  L I M I T S    FILE  note 1

 1 MASTER SNR LO         note 2    DB
 2 MASTER ECD LO         note 2    USEC
 3 MASTER ECD HI         note 2    USEC
 4 SEC 1 SNR LO          note 2    DB
 5 SEC 1 ECD LO          note 2    USEC
 6 SEC 1 ECD HI          note 2    USEC
 7 SEC 2 SNR LO          note 2    DB
 8 SEC 2 ECD LO          note 2    USEC
 9 SEC 2 ECD HI          note 2    USEC
10 OFFSET HI             note 2

 Enter new parameter value
 or press RETURN to continue.

----------------------------------------------------------------
```

Figure 3-19. J2 Monitor Alarm Limits Screen

This screen also allows the operator to change any of the parameters by entering:

n, x, <CR>

Where n is the line number of the associated parameter, x is the new value of the parameter, and <CR> is the carriage return key.

Note 1 - This field displays the time and date of filing.

Note 2 - This column displays the current executive alarm limits. The form of these parameters is the same as that described in the executive data screen.

3.6.9.3 J5 Certification Generation Setup Screen.- The LORAN CERT GEN SETUP screen provides the display and control of the programmable test generator parameters.

```
-------------------------------------------------------------*
J5  C E R T  G E N  S E T U P         FILED     note 1

 1 MASTER SNR       note 2    DB
 2 MASTER ECD       note 2    USEC
 3 SEC 1 SNR        note 2
 4 SEC 1 ECD        note 2    USEC
 5 SEC 2 SNR        note 2
 6 SEC 2 ECD        note 2    USEC
 7 GRI CODE         note 4
 8 OFFSET MAG       note 5    nm
 9 OFFSET DIR       note 6    deg
--------------------------------------------------------------
```

Figure 3-20. J5 Certification Generation Setup Screen

These parameter values are used during the LORAN Certification test function. The operator may change the parameters by entering:

n, x <CR>

Where n is the line number of the associated parameter, x is the new value of the parameter, and <CR> is the carriage return key.

Note 1 - This field displays the time and date of filing.

Note 2 - These parameters are of the same form as that described for the corresponding parameter in the executive data screen.

Note 3 - not used.

Note 4 - This parameter displays the group repetition interval (GRI) code. The GRI code is displayed as a decimal number with values from 4000 to 9999. The GRI, in usec, is calculated by multiplying the GRI code by 10. (The GRI Code specified here should be the same as that specified in screen J1.)

Note 5 - This parameter displays the magnitude of the offset vector, in NM.

Note 6 - This parameter displays the direction of the offset vector, in degrees.

3.6.9.4 J9 LORAN Monitor Test Generation Setup Screen.- The LORAN MON TEST GEN SETUP screen displays the offsets used to calculate the applied signal generator parameters which are used during the test process.

```
-------------------------------------------------------------*
J9  L O R A N  M O N  T E S T  G E N  S E T U P  FILED   note 1
                               OFFSET
 1 MASTER SNR LO               note 2    DB
 2 MASTER ECD LO               note 3    USEC
 3 MASTER ECD HI               note 3    USEC
 4 SEC 1 SNR LO                note 2    DB
 5 SEC 1 ECD LO                note 3    USEC
 6 SEC 1 ECD HI                note 3    USEC
 7 SEC 2 SNR LO                note 2    DB
 8 SEC 2 ECD LO                note 3    USEC
 9 SEC 2 ECD HI                note 3    USEC
10 OFFSET MAG                  note 4    nm
11 OFFSET DIR                  note 5    deg

 Enter new value
 or press RETURN to continue.

--------------------------------------------------------------
```

Figure 3-21. J9 LORAN Monitor Test Generation Setup Screen

These offset parameters are subtracted and added to the corresponding executive alarm limits in order to determine the applied signal generator parameter values. The operator can change the parameters by entering:

```
n, x  <CR>
```

Where n is the line number of the associated parameter, x is the new value of the parameter and <CR> is the carriage return key.

Note 1 - this field displays the time and date of filing.

Note 2 - these parameters specify SNR offsets in dB. They are positive integers with 1 dB resolution.

Note 3 - these parameters specify ECD offsets in usec.

Note 4 - this parameter specifies the magnitude of the offset vector, in NM.

Note 5 - this parameter specifies the direction of the offset vector, in degrees.

3.6.9.5 J10 Future TD Correction Values Screen. - The LORAN FUTURE TD CORRECTION VALUES screen displays the LORAN TD correction values that are to become effective at a future date.

```
--------------------------------------------------------------------------*

J10  M O N I T O R   A L A R M   L I M I T S      FILED  note 1

SEC1 TD CORRECTION            note 2        note 3
SEC2 TD CORRECTION            note 2        note 3
---------------------------------------------------------------------------
```

Figure 3-22. J10 Future TD Correction Values Screen

This screen allows the operator to change any of the parameters by entering the appropriate data for each field followed by a <CR>. Upon <CR>, the next field may be edited, sequencing through each field as <CR> is entered. The sequence is as follows: Sec 1 correction value, Sec 1 time and date, Sec 2 time and date. If no change is desired in a particular field, <CR> only is entered.

Note 1 - This field displays the time and date of filing.

Note 2 - This column displays the TD correction values that will become the TD corrections on the effective date. The form of these parameters is the same as that described in the OPERATING PARAMETERS screen.

Note 3 - This data is the date and time when the correction values specified in this screen are to become the current correction values.

3.6.10 Commands Run Tests Directory. - The Commands Run Tests Directory has four options. These options are used by the operator for performing tests on the LORAN-C Monitor.

```
--------------------------------------------------------------------------*

K   C O M M A N D S   R U N   T E S T S

  1 ABORT TEST
  2 CERT TEST
  3 TEST LORAN MON
  4 FAULT ISOLATE
---------------------------------------------------------------------------
```

Figure 3-23. K Commands Run Tests Screen

The operator may select one of the setup screens by typing the associated number and entering a carriage return.

K Commands Run Tests Directory (cont.)

Selecting 1, ABORT TEST causes the current test to terminate, with indeterminate results. After aborting the test, the system displays the LORAN-C Monitor Main Directory. Option 2, CERT TEST, is selected to perform the LORAN-C Monitor Certification Test. Option 3, TEST LORAN MON, is selected to perform the LORAN-C Monitor Test procedure. Option 4, FAULT ISOLATE, is selected to perform the LORAN-C Monitor Fault Isolation procedure.

3.6.11 <u>Commands Maintenance Directory</u>.- The Commands Maintenance Directory has two options, RECYCLE and RESET.

```
-----------------------------------------------------------------*
L  C O M M A N D S   M A I N T E N A N C E

 1 RECYCLE
 2 RESET
-----------------------------------------------------------------
```

Figure 3-24. L Commands Maintenance Screen

The COMMANDS MAINTENANCE screen allows an operator, logged on at the proper security level, to perform system RESET and RECYCLE functions. The desired function is selected by entering the option number, followed by <RETURN>.

A RECYCLE is similar to a computer "cold boot." After execution, the Program Counter and all RAM memory pointers are reset and the DATE and TIME data files are cleared. After doing a RECYCLE, the system requires reentry of user password(s), operator ID, and DATE/TIME before entering acquisition mode.

A RESET is similar to a computer "warm boot." After execution, the Program Counter and all RAM memory pointers are unaffected, and the DATE and TIME data files contain the same information that they contained before the command was executed.

3.7 <u>Security Operations</u>.- The user may have any of three levels of security assigned: Password Level, Lockout Level, or Safeguard Level, in that order, with Password being the lowest level of security available.

Password level allows the operator to view any data or parameters in the system; however, he cannot change any of the parameters. Lockout level allows the operator to change system certification parameters. Safeguard level allows the operator to perform any operations that are permitted from a local terminal.

One user may have access to all three levels while another has access to only one level. A person with password level privileges will not have access to privileges at the lockout level. A person who has access to privileges at the Lockout level will also have password level privileges but not those at Safeguard level. An operator with Safeguard level privileges also has Password and Lockout level privileges.

An operator with Safeguard Level clearance who logs on must enter the Password and Lockout Levels before being able to access Safeguard Level. If the operator tries to access Safeguard Level immediately when logging on, the system prompts first for the Password and then for the Lockout key. There is no password that will give access directly to Safeguard Level.

For example, if security is enabled and the user tries to access the Executive Data Screen before entering his password, instead of displaying the screen, the system displays the following message:

```
PASSWORD LEVEL REQUIRED
```

The user cannot access the data without the password. To gain access, the operator selects 1 from the Security Directory by pressing 1 and then pressing RETURN. The system responds with the following display:

```
ENTER PASSWORD KEY
```

The user must respond with the key for password level. The three password keys are discussed in the following paragraphs.

3.7.1 Logon Password Level.- The default key for Password level is LORAN1. If the operator enters the correct key, the system displays the following message:

```
PASSWORD LEVEL LOGON SUCCESSFUL
```

3.7.2 Logon Lockout Level.- To gain Lockout level access, the operator must have first gained access to Password level. Then the operator selects 2 from the Security Directory by pressing 2 and then pressing RETURN. The system responds with the following display:

```
ENTER LOCKOUT KEY
```

The default key for Lockout Level is LORAN2. If the operator enters the correct key, the system displays the following message:

```
LOCKOUT LEVEL LOGON SUCCESSFUL
```

If the operator tries to log on at any level and fails to give the correct password, he is permitted three tries before being locked out of the system. After three failures, the system leaves the Security screen and rewrites the Main Menu. The user then has the option of starting over with the security logon sequence at whatever security level he had in the beginning.

3.7.3 Logon Safeguard Level.- To gain Safeguard Level access, the operator must have first gained access to Password and Lockout Levels. Then the operator selects 3 from the Security Directory by pressing 3 and then pressing RETURN. The system responds with the following display:

```
ENTER SAFEGUARD KEY
```

The default key for Safeguard Level is LORAN3. If the operator enters the correct key, the system displays the following message.

```
    SAFEGUARD LEVEL LOGON SUCCESSFUL
```

After Safeguard Level logon is complete, the operator is prompted for operator ID: ENTER OPERATOR ID.

Once the operator is granted Safeguard Level access, he has the highest level of security available. This allows him to perform any operations that are permitted from a local terminal.

3.7.4 Change Security Keys.- The operator must have Safeguard Level access before being able to change any of the security keys. To change any of the security keys, the operator presses 4 and the RETURN. The following screen is displayed:

```
          A     CHANGE PASSWORD KEY
          B     CHANGE LOCKOUT KEY
          C     CHANGE SAFEGUARD KEY
          D     RETURN TO LORAN DIRECTORY
```

To change the Password key, for example, the operator presses A and then RETURN. The following screen is displayed:

```
    LORAN1 IS THE CURRENT PASSWORD KEY.
    ENTER NEW KEY OR PRESS CR TO EXIT.
```

If the operator enters TEST1, for example, then the new Password Level key is TEST1 until someone changes it again.

3.7.5 Logoff Monitor.- Option 5 permits the operator to leave the system operating unattended without the danger of someone without proper security level accessing sensitive data or performing unauthorized operations.

For example, if an operator has been using the system while logged on at Safeguard Level and wishes to leave the system temporarily, he can select option 5, by pressing 5 and then pressing RETURN. The system continues operation but with security status reset to zero, with no security level active. Before anyone else can use the system they must log on at their authorized security level.

3.7.6 Return to LORAN Directory.- To return to the main directory, the operator must press 6 and then press RETURN.

Table 3-4 shows the security access structure for the LORAN-C Monitor.

Table 3-4. LORAN-C Monitor Security Access Structure

Default Keys: (uppercase only)		
Password Level:	LORAN1	V = View data or current parameters
Lockout Level:	LORAN2	C = Change current parameters
Safeguard Level:	LORAN3	E = Execute Command

Command	Command Description	Minimum Level Required Password	Lockout	Safeguard
B	Display Executive Parameters	V		
C	Display Alarm History	V		
D	Display Certification Data	V		
I14	Display Fault Isolate Results	V		
I15	Display Monitor Test Results	V		
I16	Display 10 Minute Averages	V		
I17	Display 4 Hour Averages	V		
I18	Display Blink Data	V		
I19	Display 1 Second Alarm Data	V		
I20	Display 1 Minute Alarm Data	V		
J1	Operating Parameters	V		C
J2	Alarm LImits	V		C
J5	Certification Parameters	V	C	
J9	Monitor Test Parameters	V		C
J10	Future TD Correction Values	V		C
J11	Set Time and Date	C		
J12	Clear Archives and Install Defaults			E
K1	Abort Test			E
K2	Certification Test			E
K3	Monitor Test			E
K4	Fault Isolate			E
L1	Recycle			E
L2	Reset			E

3.8 Front Panel LCD Display.- The Front Panel LCD Display (See figure 3-25) presents the LORAN-C Monitor Executive Data parameters. Pressing the front panel DISPLAY SELECT pushbutton causes the LCD Display to scroll through each parameter. This provides a "snapshot" of the most recent value of these parameters.

This information is used during Maintenance and Process Data Collection; and Collection and Dispatching of Real-Time Data.

```
         +-----------------------------------------------+
         |                                               |
(title)  |Selected GRI                                   |
         |-------+---------+---------------+--+----------|
         |       |         |               |  |          |
         |       |7980     |               |us|          |
         +-------+---------+---------------+--+----------+
              (variable)                (units)
```

Figure 3-25. Front Panel LCD Display

NOTE: The Front Panel Display has open access; therefore, data may be displayed without entry of security clearance.

Table 3-5 lists the parameters which are presented by the Front Panel LCD Display. For each parameter, the table shows the title, its format, and the units in which it is displayed.

Table 3-5. LCD Display Parameters

Title	Format	Units
Selected GRI	9999	us
Master Signal SNR	S99	dB
Master Signal ECD	S9.9	us
Secondary 1 TD	99999.99	us
Secondary 1 SNR	S99	dB
Secondary 1 ECD	S9.9	us
Secondary 2 TD	99999.99	us
Secondary 2 SNR	S99	dB
Secondary 2 ECD	S9.9	us

4.1 INTRODUCTION.- This section contains equipment parameters and specifications pertinent to system operation.

4.2 STANDARDS AND TOLERANCES. - The parameters are listed, as well as their standards and tolerances. Only system parameters which directly effect the system accuracy and are directly or indirectly listed within the instruction book are listed. The following paragraphs contain a brief description of the fields used in the Standards and Tolerances chart, Table 4-1.

4.2.1 Parameter. - This field contains the parameter by title. The identifying letter will be used as reference to the parameter for other sections of the instruction book. An arrow (-->) will be used preceding each identifying letter when that parameter is critical to the normal operation of the system and may cause a degradation of confidence in the accuracy of the system.

4.2.2 Procedure Paragraph Reference. - This field contains the test paragraph of section 6 of the instruction book. The paragraph in section 6 will describe the procedures used to establish the value of the parameter.

4.2.3 Standard. - This field contains the nominal value of the parameter and is compatible with the system design objectives.

4.2.4 Initial Tolerance Limit. - This field contains the maximum deviation, above and below the standard value, that is permissible when the equipment is initially commissioned. The values used are absolute and plus or minus entries are not used, i.e., +/- .014%.

4.2.5 Operating Tolerance Limit. - This field contains the maximum deviation, above and below the standard value, over which the equipment may continue to operate without adjustment or corrective maintenance, and beyond which remedial action is required. As for initial tolerance entries, plus and minus figures are not used.

TABLE 4-1
STANDARDS AND TOLERANCES

CPU TIMING				
PARAMETER	PROCEDURE PARAGRAPH REFERENCE	STANDARD	INITIAL TOLERANCE LIMIT	OPERATING TOLERANCE LIMIT
A) SYSTEM CLOCK TEST POINT (TP5)	6.2.4.1	5.0 MHz	WITHIN 100 ppm OF STANDARD NOTE 1	SAME AS INITIAL
B) BRCLK TEST POINT (TP6)	6.2.4.2	2.4576 MHz	WITHIN 100 ppm OF STANDARD NOTE 2	SAME AS INITIAL
-->C) LORAN CLOCK TEST POINT (U16 PIN 9)	6.2.4.3	8.0 MHz	WITHIN 10 ppm OF STANDARD NOTE 3	SAME AS INITIAL

005-34-2004

NOTE 1: THIS PROVIDES A WORST CASE ERROR OF +/- 4.5 MINUTES PER MONTH FOR THE REAL TIME CLOCK.

NOTE 2: AT THE LOW BAUD RATES USED BY THE SYSTEM, THIS ERROR IS INSIGNIFICANT.

NOTE 3: THIS IS ADEQUATE FOR THE LORAN RECEIVER ACQUISITION MODE. AFTER TRACKING IS ESTABLISHED, THE LORAN SIGNAL ITSELF IS USED AS A TIME BASE.

TABLE 4-1
STANDARDS AND TOLERANCES

POWER SUPPLY				
PARAMETER	PROCEDURE PARAGRAPH REFERENCE	STANDARD	INITIAL TOLERANCE LIMIT	OPERATING TOLERANCE LIMIT
A) UNREGULATED DC VOLTAGE TEST POINT (TP1)	6.2.5.1	28.0 VDC	NOT < 25 VDC NOT > 32 VDC NOTE 1	NOT < 22 VDC NOT > 33 VDC
- ->B) Vcc TEST POINT (TP6)	6.2.5.2	5.1 VDC	WITHIN 0.05 VDC OF STANDARD NOTE 2	<5.2 VDC >5.05 VDC
- ->C) +15 VDC TEST POINT (TP7)	6.2.5.3	+15.0 VDC	NOT < 15 VDC NOT > 17 VDC	SAME AS INITIAL
- ->D) -15 VDC TEST POINT (TP8)	6.2.5.4	-15.0 VDC	NOT < - 17 VDC NOT > - 15 VDC NOTE 3	SAME AS INITIAL
- ->E) COMPARATOR REFERENCE VOLTAGE TEST POINT (TP11)	6.2.5.5	+4.3 VDC	WITHIN .05 VDC OF STANDARD NOTE 4	SAME AS INITIAL
F) 24 VAC SUPPLY TRANSFORMER T1 TERMINALS P1 AND P3	6.2.5.6	24 VAC	NOT < 21 VAC NOT > 28 VAC NOTE 5	SAME AS INITIAL

004-34-2004

NOTE 1: THIS RANGE OF VOLTAGE FALLS WITHIN THE INPUT REQUIREMENT OF THE DC/DC CONVERTER.

NOTE 2: THIS TOLERANCE GUARANTEES THAT THE MAXIMUM AND MINIMUM VCC REQUIREMENT FOR ALL IC'S IN THE SYSTEM WILL NOT BE VIOLATED.

NOTE 3: THIS TOLERANCE GUARANTEES THAT THE LORAN RECEIVER AND SIMULATOR ON-BOARD REGULATORS WILL BE PROVIDED WITH ADEQUATE VOLTAGE FOR PROPER OPERATION.

NOTE 4: THIS TOLERANCE MAINTAINS A SAFE MARGIN FOR THE DEEP DISCHARGE PROTECTION FOR THE BATTERIES.

NOTE 5: THIS TOLERANCE GUARANTEES THAT THE UNREGULATED DC VOLTAGE WILL FALL WITH TOLERANCE.

SECTION 5 - PERIODIC MAINTENANCE

5.1 INTRODUCTION.- This section lists maintenance activities to be performed on the LORAN-C Monitor System. Periodic maintenance for the LORAN-C Monitor System is classified into two categories -- electrical and mechanical.

5.1.1 General Requirements for Electrical/Electronic Equipment.- When performing periodic maintenance on electrical and electronic equipment on the LORAN-C Monitor System the following shall be included:

electrical component mountings - inspect for security;

electrical wire bundles - inspect for chafing, damage, and security;

electrical connectors - inspect for corrosion, damage, and security.

5.1.2 General Requirements for Mechanical Equipment..- When performing periodic maintenance on the mechanical equipment on the LORAN-C Monitor System, the following shall be included:

Battery Connections - Inspect for corrosion and security.

Chassis Components and Modules - Inspect for proper mounting and mechanical alignment.

All Mechanical Fasteners - Inspect for security.

External Cables - Inspect all cable runs for wear, chafing, damage, other signs of deterioration, and security.

Monitor Antenna. Coupler and Antenna Mount - Inspect for damage, structural integrity, security of antenna, and simulator connectors at coupler.

5.2 PERFORMANCE CHECKS..- Performance checks shall be carried out when visual inspections and condition checks have been completed and system interconnections have been restored. Performance Checks are required at the following times:

after initial installation or subsequent modification;
after completion of any corrective maintenance;
after return to service of any unit removed for repair or calibration.

Table 5-1 lists the performance checks and shows where each procedure is located in Section 6.

Table 5-1. Performance Checks

Performance Check	Procedure
a. Self Test	Paragraph 6.2.1
b. Certification Test	Paragraph 6.2.2

For Standards and Tolerances, see Table 4-1 in Section 4.

5.3 OTHER ON-SITE MAINTENANCE.- This requirement is Not Applicable to the LORAN-C Monitor System.

5.4 OFF-SITE MAINTENANCE.- This requirement is Not Applicable to the LORAN-C Monitor System.

6.1 INTRODUCTION.

6.2 PERFORMANCE CHECK PROCEDURES. - Performance Check procedures consist of the LORAN-C Monitor Self Test and the LORAN-C Monitor Certification Test. Both of these tests shall be run after any part has been replaced, after any repair procedure has been performed, or after new equipment is installed. To verify that the equipment is operating within specified operating tolerances, perform the Monitor Test procedure, paragraph 7.2.2.

6.2.1 LORAN-C Monitor Self Test. - The LORAN-C Monitor Self Test is an automatic test which is run in the background and is continually performed by the system software. It requires no specific command from the Facilities Central Processing Unit (FCPU) or local terminal. The test includes background diagnostic testing of the ROM and power supply. It also includes queries to the receiver module for a status word. The status word is determined by each module's individual diagnostics. When a failure is detected by these tests, the Monitor Self Test Fail bit is set, which indicates that the LORAN-C Monitor has detected a failure. Fault isolation must be initiated at the FCPU or IOT. This is accomplished by the Fault Isolation command (see Section 7). To determine whether this test has identified a failure, perform the procedure in paragraph 6.2.1.1.

If a failure is identified, confirm the failure by performing the Fault Isolation procedure in Paragraph 7.2. Then perform the indicated maintenance procedure. Then check system performance by performing the Certification Test in paragraph 6.2.2.

6.2.1.1 Self Test Procedure. - This test comprises three parts:

a. The test is automatically run in background mode and tests the following:

RAM
ROM Checksum
Nonvolatile RAM
UARTS
Power Supply Outputs
Simulator
Receiver
Battery Voltage

b. Also, during communications with the Receiver and Simulator, they each send back status bits to the Monitor Processor. If a failure is detected, the Monitor Processor sets the self test fail bit to the FCPU.

c. The Monitor Processor also writes the self-test result to the FAULT ISOLATION RESULTS file (screen I14).

Use the following procedure to determine the results of the Self-Test:

1. From the LORAN-C Monitor Main Directory, select I, MAINTENANCE DATA DIRECTORY. The MAINTENANCE DATA DIRECTORY screen (I) appears.

2. Type in 14.

3. Examine the data displayed. Any failures are spelled out.

Example: If the CPU RAM failed, the following message is displayed:

CPU MODULE RAM FAILED.

6.2.2 LORAN-C Monitor Certification Test.- The LORAN-C Monitor Certification Test is an operator-initiated test which can be performed either from the local terminal or the FCPU. This test may also be initiated on system power-up by disabling SW1-8, positioning it to the OFF position. The procedure is presented in the following paragraphs. The LORAN-C Monitor certification function verifies that the monitor will not report an alarm condition under good signal in-space situations. During the certification test, the monitor is commanded to set up the LORAN-C signal generator with signal parameters that:

a. Reside in the J5 screen. These parameters must be specified such that they are within the alarm limits specified in screen J2.

b. Measure the output of the LORAN-C signal generator with the receiver.

c. Compare the measured parameters against the alarm limits.

d. If the certification test causes an alarm, it has failed. The operator must isolate the fault at the module level (refer to Fault Isolation Command paragraph 3.6.10 or 7.1.1.3). The certification test is successful if the generated signal and the receiver-measured signal did not cause an alarm. By selecting signal parameters close to the alarm limits, receiver operating tolerances can be verified. Selection of the "D" option at the Main Menu will give the certification test results.

The LORAN-C signal generator is controlled by using the LORAN-C MONITOR CERTIFICATION SETUP file. This is a read/write, fixed-length file containing data which set the characteristics of the LORAN-C signal generator. The Signal-to-Noise Ratio (SNR), Envelope-to-Cycle Difference (ECD), and group repetition interval (GRI) are controlled by the data in the LORAN-C MONITOR CERTIFICATION SETUP file. The GRI specified should be the same as that specified in the J1 screen. The data are used to set the LORAN-C signal generator for measurements to be made. After issuing the LORAN-C MONITOR CERTIFICATION COMMAND, the data are measured by the receiver and reports are sent to the Monitor.

The LORAN MONITOR CERTIFICATION COMMAND causes the following to occur:

a. Set MONITOR BYPASSED and MONITOR BUSY bits.

b. Apply the generator's signal (as specified in the LORAN MONITOR SETUP file) to the receiver.

c. Measure the output of the simulator.

d. File the results in the LORAN MONITOR CERTIFICATION RESULTS file.

e. Set the MONITOR SELF TEST FAIL bit and CERTIFICATION FAIL bit if results are found to be out of tolerance.

f. Clear the MONITOR BUSY bit.

When the MONITOR BUSY bit is cleared, the FCPU is notified that the LORAN-C MONITOR CERTIFICATION RESULTS file contains valid data. This file is a fixed-length, read-only file and contains the results of the latest receiver measurement.

Certification data collection software will evaluate all measured parameters and compare them to specified alarm limits. It will present the information for display and/or remote transmission. These parameters will be measured without need for human intervention. The software determines that all parameters are within prescribed limits. This certification program may be an operator command at any time and may be done on POWER-UP. The certification results are ready for transfer to the FCPU within 7 minutes from the start of the certification test. The results of the measurements are stored in nonvolatile memory locally for transfer to the controlling site upon request.

The parameters and limits are programmable to allow for changes by the FCPU or by an operator at the input/output terminal having the proper security clearance and passwords as described in paragraph 3.6.7.

6.2.3 Certification Test Procedure.- This paragraph presents the LORAN-C Monitor Certification test procedure.

1. From the LORAN-C Monitor Main Directory, select J, Parameter Setup Directory. Screen 'J' appears.

2. Select 5, CERT GEN SETUP. Screen '5' appears.

3. Enter values, as prescribed for the site by the FAA. The values specified must be within the alarm limits specified in screen J2. The GRI should be the same as that specified in screen J1.

NOTE

In this and all other procedures, to enter a value, select its number, followed by a comma, followed by the value.

4. After values are entered, press <RETURN> to return to the LORAN-C Monitor Main Directory.

5. Select K, COMMANDS RUN TEST. Screen 'K' appears.

6. Select 2, CERT TEST.

NOTE

Total time should be less than 7 minutes running except on screen B.

7. To tell whether the test is running, press <RETURN>, to return to the LORAN-C Monitor Main Directory.

8. Select B, MONITOR EXEC DATA. Screen 'B' appears.

9. Examine the line labeled, CERT ACTIVE. If the response is Y(for Yes), the test is still active. If the response is No, the test is over. Note that this line is not updated automatically. To get an update, you must press selection B from the LORAN-C Monitor Main Directory.

10. When the test is finished, examine the line labeled CERT RESULT. This is a pass/fail indication. If the response is GOOD, the test passed. A failure is indicated by BAD.

11. Press <RETURN>, to return to the LORAN-C Monitor Main Directory.

12. Select D, MON CERT DATA. Screen 'D' appears.

13. Examine the columns labeled SET and MEAS. SET contains the setup data values. MEAS contains the values measured during the test.

6.2.4 CPU Timing. - All measurements described in these procedures are written assuming that the CPU board is installed in a LORAN-C Monitor and that all power supply voltages are within the specified tolerances.

6.2.4.1 System Clock.

1. To measure the frequency of the CPU system clock, ground the frequency meter probe at test point TP4 on the CPU board.

2. Connect the probe input to test point TP5.

3. The frequency at this point should be 5 MHz, +/- 100 PPM.

4. No adjustment of the frequency is possible. If the frequency is out of tolerance, replace the CPU board.

6.2.4.2 Loran Clock.

1. To measure the frequency of the LORAN clock, ground the frequency meter probe at test point TP4 on the CPU board.

2. Connect the probe input to test point to pin 9 of U16.

3. The frequency at this point should be 8 MHz, +/- 3 PPM.

4. If the frequency is out of tolerance, adjustment is performed by removing the tape over the adjustment access hole on the top of oscillator G1 and adjusting the frequency of the oscillator. Replace the tape on the access hole when the adjustment is complete.

6.2.5 Power Supply. - All procedures in this section are written assuming that the power supply is installed in the LORAN-C Monitor and standard AC power is applied, unless otherwise specified.

6.2.5.1 Unregulated DC Voltage.

1. To measure the unregulated DC supply voltage, connect the ground probe to test point TP9.
2. Measure the voltage at test point TP1.
3. The voltage at this point should be greater than 28 VDC.
4. No adjustment for this voltage is available.

6.2.5.2 Vcc, Regulated 5 Vvolt Ssupply.

1. To measure the regulated 5 volt supply, connect the ground probe to test point TP9.
2. Measure the voltage at test point TP6.
3. The voltage at this point should be 5.1 VDC, +/- .05 VDC.
4. Should this voltage be out of tolerance, it may be adjusted by monitoring the voltage at TP6 and turning potentiometer R25 with small flat blade adjustment tool.

6.2.5.3 +15 VDC Supply Voltage.

1. To measure the regulated +15 volt supply, connect the ground probe to test point TP9.
2. Measure the voltage at test point TP8.
3. The voltage at this point should be less than -15 VDC.
4. No adjustment for this voltage is available.

6.2.5.4 Comparator Reference Voltage.

1. To measure the comparator reference voltage, connect the ground probe to test point TP9.
2. Measure the voltage at test point TP11.
3. The voltage at this point should be 4.3 VDC, +/- .05 VDC.
4. Should this voltage be out of tolerance, it may be adjusted by monitoring the voltage at TP11 and turning potentiometer R18 with a small flat blade adjustment tool.

6.2.5.5 24 VAC Supply.

1. Ensure that all internal modules are properly interconnected.

2. Apply nominal AC power and turn the monitor power switch on.

3. Measure the AC voltage across TIPI and TIP3. Reference drawing 000700 for locations.

4. The AC voltage should be between 21 and 28 VAC.

6.3 OTHER MAINTENANCE PROCEDURES.- This requirement is Not Applicable to the LORAN-C Monitor System.

6.4 SPECIAL MAINTENANCE PROCEDURES.- This requirement is Not Applicable to the LORAN-C Monitor System.

SECTION 7 - CORRECTIVE MAINTENANCE

7.1 INTRODUCTION.- Corrective maintenance for the LORAN-C Monitor consists of failure detection, on-site corrective maintenance, and off-site corrective maintenance. None of the on-site corrective maintenance procedures require the facilities of a maintenance depot.

7.1.1 On-Site Failure Detection.- Four different tests are available to implement on-site failure detection in the LORAN-C Monitor. These tests are:

LORAN-C Monitor Self Test;
Certification Test;
Fault Isolation Test;
LORAN-C Monitor Test.

7.1.1.1 LORAN-C Monitor Self Test.- This is an automatic test which is continually run in background mode. The operator checks the results of this test during performance checks (refer to paragraph 6.2.1).

7.1.1.2 Certification Test.- This is an operator-initiated test which can be initiated at either the FCPU or the local terminal. If SW2-8, located on the MCPU Board, is disabled (OFF) this test will be run whenever the LORAN-C Monitor is powered up or recycled. The operator performs this test as part of the performance checks (refer to paragraph 6.2.2).

7.1.1.3. Fault Isolation Test.- This is an operator-initiated test which can be initiated at either the FCPU or the local terminal. The operator performs this test as part of the on-site fault isolation procedure. The MONITOR FAULT ISOLATION COMMAND causes the monitor to perform fault isolation testing. The fault isolation results return to the Fault Isolation Results file. Fault isolation testing consists of foreground diagnostics executed when the LORAN-C Monitor is in an off-line mode. These foreground diagnostics include the following:

RAM Test,
ROM Test,
UARTS Test,
Liquid Crystal Display Test,
Power Supply Low/In Test,
Power Supply Low/Out Test,
EEPROM Modules Test,
Receiver and Simulator Module Test.

The Fault Isolation command invokes the foreground diagnostics and reports the results of both the foreground and background diagnostics. If any test fails, the Self Test Fail Bit is set.

7.1.1.4 Monitor Test.- This is an operator-initiated test which can be initiated at either the FCPU or the local terminal. The procedure is presented in the following paragraphs. The LORAN-C Monitor Test function verifies that the LORAN-C Monitor is capable of detecting both alarm and nonalarm conditions, thereby verifying system operation.

During the test, the MONITOR TEST function sets up the LORAN-C signal generator with signal parameters offset high and low from the alarm limits, measures the output of the signal generator with the receiver, compares the measured signal parameters against the alarm limits, and displays the results of the test.

By selecting offsets which correspond to the receiver operating tolerances, receiver operation can be verified. By creating alarm and nonalarm conditions, the operation of the monitor CPU module is verified. Invoking the MONITOR TEST command causes the monitor to perform the following:

a. Sets the MONITOR BUSY and MONITOR BYPASSED bits.

b. The signal generator output is applied to the LORAN-C Receiver and used to verify that the LORAN-C Monitor is capable of detecting both alarm and non-alarm conditions. The specific parameter values applied to the signal generator are determined from the files (the CURRENT LORAN MONITOR ALARM LIMITS file and the LORAN MONITOR TEST SETUP file).

c. The LORAN MONITOR TEST SETUP is a fixed length read/write file containing offsets that are added to or subtracted from the values of the CURRENT LORAN MONITOR ALARM LIMITS file. The results represent signal generator setups. The monitor test process uses these results and verifies the following for each parameter:

(1) applying a result which is beyond the alarm limit causes an alarm to be detected.

(2) applying a result which is within the alarm limit causes no alarm to be detected.

d. The results of the monitor test measurements are filed in the LORAN MONITOR TEST RESULTS file. This file contains the actual measurement values obtained, along with a Pass/Fail indication for each result measured.

e. Clears the MONITOR BUSY and MONITOR BYPASSED bits, thus notifying the FCPU that valid data has been filed in the LORAN MONITOR TEST RESULTS file and may be retracted.

f. If any of the MONITOR TEST results indicate a failed condition, the MONITOR SELF TEST FAIL bit is set.

7.2 On-Site Failure Detection Procedures.- This section presents procedures for the Fault Isolation Test and the LORAN-C Monitor Test.

7.2.1 Fault Isolation Test Procedure.

NOTE

During this test, the LORAN-C Monitor does not measure received signal parameters.

1. From the LORAN-C Monitor Main Directory, select K, COMMANDS RUN TEST Directory. Screen 'K' appears.

2. Select K4, FAULT ISOLATE. The test runs. While the test is running, the message, "LORAN FAULT ISOLATION," will appear on the front panel display.

3. When the test finishes, the system automatically resets and redisplays the LORAN-C Monitor Main Directory. From the Main Menu, you may determine if the Fault Isolation has passed by referencing the "SELF TEST RESULT" column.

4. Select I, MAINTENANCE DATA DIRECTORY. Screen 'I' appears.

5. Select 14, FAULT ISOLATE TEST RESULTS.

6. Examine the data displayed, as with the Self Test. The word "NONE" indicates that no information was detected.

7.2.2 LORAN-C Monitor Test Procedure.

1. From the LORAN-C Monitor Main Directory, select J, Parameter Setup Directory. Screen 'J' appears.

2. Select 9, LORAN MON TEST GEN SETUP. Screen 'J9' appears.

3. Enter values, as prescribed for the site by the FAA. Values entered should be such that, when added to or subtracted from the corresponding alarm limit in screen J2, they will not exceed the operation or measurement limits of the receiver.

NOTE

In this and all other procedures, to enter a value, select its number, followed by a comma, followed by the value.

4. After values are entered, press <RETURN> to return to the LORAN-C Monitor Main Directory.

5. Select "K," Commands Run Tests. Screen "K" appears.

6. Select 3, TEST LORAN MONITOR.

NOTE

There is no indication that the test is running except on screen B. Total time is between 20 minutes and 1 hour.

8. Examine the line labeled, MON TEST ACTIVE. If the response is YES, the test is still active. If the response is No, the test is over. Note that this line is not updated automatically. To get an update, you must press selection B from the LORAN-C Monitor Main Directory. Estimated total time for the test is from 20 minutes to 1 hour. The Monitor Test Results is indicated on screen B under Self Test Results. If the indication is GOOD, the Mon Test was successful. If the indication is BAD, check screen I14 to see if any module failures occurred. If not, check screen I15 for Mon Test Results.

9. Press <RETURN>, to return to the LORAN-C Monitor Main Directory.

10. Select I, MAINTENANCE DATA DIRECTORY. Screen 'I' appears.

11. Select I15, LORAN MONITOR TEST RESULTS.

12. Examine the data displayed. Failed items are preceded by an asterisk (*).

7.3. ON-SITE CORRECTIVE MAINTENANCE.- On-site corrective maintenance for the LORAN-C Monitor consists of fault isolation to the replaceable assembly or module and removal/replacement of those assemblies or modules.

7.3.1. Fault Isolation To Replaceable Assembly or Module.- The on-site fault isolation procedure is presented in Table 7-1. In the following procedures, after replacing a faulty module or component, be sure to perform the clean-up procedure described in paragraph 7.3.2 before returning the system to service. Perform the following procedure after a failure occurs and is detected. The malfunctions are presented in the order in which they are most likely to occur.

Table 7-1. On-Site Troubleshooting Procedure

Malfunction	Test or Inspection	Corrective Action
A. SELF-TEST FAIL BIT IS SET		

NOTE

At any time the Receiver is replaced, if a line driver to receiver cable is mistakenly not reconnected,- it may be necessary to reset the Monitor before the system will initialize properly.

	1. Review fault isolation results file. Is a defective module indicated?	Remove/replace defective module, except power supply. If power supply voltage is low, go to Malfunction B, LOW POWER SUPPLY VOLTAGE. See second note following.

NOTE

If Fault Isolation results list all or almost everything, remove/replace EEPROM No. 1.

Table 7-1. On-Site Fault Isolation Procedure (cont.)

Malfunction	Test or Inspection	Corrective Action
	2. Perform the Fault Isolation Test. Is a faulty module indicated?	Remove/replace defective module, except power supply. If power supply voltage is low, go to Malfunction B, LOW POWER SUPPLY VOLTAGE. See second Note following.
		NOTE Certain MCPU faults might cause the self test and the fault isolation test to erroneously indicate a module that is not defective. If clean-up steps 1-5 (Procedure 7.3.2) result in an indication that the replacement module is also defective, remove/replace the MCPU module and perform clean-up steps 1-5 (Procedure 7.3.2) before continuing.
	3. Manually isolate the fault.	
B. POWER SUPPLY VOLTAGE IS LOW		
	1. Check transformer output voltage between T1P1 and T1P3. If the transformer output voltage is OK, (24 VAC), and security and continuity of wire harness is OK, remove/replace the power supply.	
	2. Check transformer input voltage between T1P4 and T1P5.	If input voltage (120 VAC) is OK, remove/replace the transformer.
	3. Check external voltage for proper value.	If not OK, correct external voltage problem.

WARNING

SHOCK HAZARD!! Use extreme caution when measuring AC voltages to prevent bodily harm or damage to equipment.

Table 7-1. On-Site Fault Isolation Procedure (cont.)

Malfunction	Test or Inspection	Corrective Action
	4. Check for short or open circuit between and including the transformer and power receptacle/filter (fuse, fuse holder, AC wire harness, rocker switch). See procedure for isolating fault.	If not OK, remove/replace component.
	5. Check voltage between XFP1 and J1P1.	If not 120 VAC, remove/replace wire harness.
	6. Check voltage between XFP2 and J1P1.	If not 120 VAC, remove/replace fuse or fuse holder.
	7. Check voltage between S1P2 and J1P1.	If not 120 VAC, remove/replace wire harness.
	8. Check voltage between S1P1 and J1P1.	If not 120 VAC, remove/replace rocker switch.
	9. Check voltage between T1P5 and J1P1.	If not 120 VAC, remove/replace wire harness or power supply.
	10. Check voltage between T1P4 and J1P3.	If not 120 VAC, remove/replace wire harness.
	11. With power cord disconnected, check continuity between T1P4 and T1P5.	If not continuous, remove/replace transformer.

Table 7-1. On-Site Fault Isolation Procedure (cont.)

Malfunction	Test or Inspection	Corrective Action

C. CERTIFICATION TEST FAILURE

1. Review Certification Test Data File. Does any data parameter have a value which may trigger an alarm? Recheck Monitor Alarm Limit settings and Cert Test Setup values.

    Run Fault Isolate Test.

2. Review fault isolation results file. Is a defective module indicated?

    Remove/replace defective module, except power supply. If power supply voltage is low, go to Malfunction B, LOW POWER SUPPLY VOLTAGE. For other power supply faults, remove/replace power supply.

3. If no failure is indicated, rerun the Cert Test.

4. If the Cert Test fails a second time, perform manual fault isolation procedure.

D. MONITOR TEST FAILURE

1. Check J2 and J5 screens for combinations of parameters which are out of the operation or measurement limits of the receiver.

2. Review fault isolation results file. Is a defective module indicated?

    Remove/replace defective module, except power supply. If power supply voltage is low, go to Malfunction B, LOW POWER SUPPLY VOLTAGE. For other power supply faults, remove/replace power supply.

3. Perform the Fault Isolation Test. Is a faulty module indicated?

    Remove/replace defective module, except power supply. If power supply voltage is low, go to Malfunction B, LOW POWER SUPPLY VOLTAGE.

4. If no failed module is found, re-run the Monitor Test.

5. If the Monitor Test Fails a second time, perform manual fault isolation procedure.

Table 7-1. On-Site Fault Isolation Procedure (cont.)

Malfunction | Test or Inspection | Corrective Action

E. LOSS OF LCD PARAMETERS

This procedure is the same as that presented under Malfunction A, SELF TEST FAIL BIT IS SET. If fault isolation test doesn't indicate a faulty LCD, but the LCD doesn't display parameters, remove/replace LCD.

F. LOSS OF COMMUNICATION AT THE FCPU

1. Check the IOT port for proper operation.

   If OK, proceed to step 2.

2. Check the LCD Display for proper parameters.

   If OK, proceed to step 3.

3. Check power supply voltage levels at TP6 (+5 V), TP7 (+15 V), and TP8 (-15 V) with respect to TP9 (GND).

   If voltage levels are OK and power supply/MCPU INTF cable security and continuity OK, remove/replace the MCPU, or else go to Malfunction B.

   If not OK, remove/replace power supply/MCPU INTF cable.

4. Check FCPU communications.

   If not OK, remove/replace MCPU/FCPU interface cable.

G. LOSS OF COMMUNICATION AT THE IOT

1. Check the FCPU port for proper operation.

   If OK, proceed to step 2.

2. Check the LCD Display for proper parameters.

   If OK, proceed to step 3.

Table 7-1. On-Site Fault Isolation Procedure (cont.)

Malfunction | Test or Inspection | Corrective Action

3. Check power supply voltage levels at TP6 (+5 V), TP7 (+15 V), and TP8 (-15 V) with respect to TP9 (GND).

If OK, remove/replace MCPU, or else go to Malfunction B.

NOTE

When you have to check power supply voltage levels, check voltages on the MCPU, or at the MCPU end of the power supply/MCPU cable before you replace the MCPU.

H. ROCKER SWITCH NOT ILLUMINATED

1. Observe the LCD Display and LEDs.

If OK, and the monitor is operating from external power, remove/replace rocker switch bulb, or else go to (4).

2. With bulb replaced, does rocker switch illuminate?

If not OK, continue.

3. Check rocker switch and wiring harness for continuity and security between T1P1 and S1P5 and between T1P3 and S1P6. Voltage between S1P5 and S1P6 should be 24 VAC.

If not OK, remove/replace component.

4. Check external power.

If not OK, correct external power problem.

5. Remove/check/replace fuse. Do not reapply power yet.

If fuse was OK, go to (8), or else continue to next step.

6. Apply power and check system operation.

If not OK, remove/check and replace the fuse again.

Table 7-1. On-Site Fault Isolation Procedure (cont.)

Malfunction	Test or Inspection	Corrective Action
	7. If the fuse was not OK, disconnect power cord and all cables from power supply.	Isolate short circuit or other fault causing fuse to blow.
	WARNING SHOCK HAZARD!! Be certain power cord is disconnected.	
	8. Check transformer input voltage between T1P4 and T1P5.	If input is not 120 VAC, go to Step 4 of Malfunction B.
	9. Check transformer output voltage between T1P1 and T1P3.	If output is not 24 VAC, remove/replace transformer.
I. LOSS OF LED OUTPUT		
	1. Check to see if only one LED output is missing.	Remove/replace the LED, or else go to step 3.
	2. Is LED output restored?	Troubleshoot and repair the MCPU/LED interface cable assembly.
	3. Is LED output restored?	Remove/replace MCPU.
J. NO OBVIOUS FAULT		
	1. Run Fault Isolation Procedure.	Remove/Replace Defective Module or Else perform Manual Fault Isolation (See paragraph 7.3.1.1.).

7.3.1.1 Manual Fault Isolation Procedure for Antenna Coupler, Simulator, Receiver. - This test is to be used when the Monitor Test or Certification Test fails, and Fault Isolation command does not isolate the fault.

Certain receiver and simulator faults cannot be detected by the monitor self test or the monitor fault isolation test. For instance, an out-of-tolerance receiver, and out-of-tolerance simulator, a failed antenna coupler (ACU), or a failed coupler cable driver are detected only when the monitor fails the Monitor Test or the Certification Test.

Use the following procedure to isolate the defective unit.

1. Check +5, +/-15 VDC levels going to the simulator.
2. If good, remove and replace receiver; or else remove and replace MCPU.
3. Run Certification Test; if not good, remove and replace simulator.
4. Run Certification Test; if not good check ACU and external cabling. Remove and replace failed component.
5. Run Certification Test; If after 6 minutes the monitor has not gone into track mode, replace simulator board.

NOTE

If certification test does not finish within 7 minutes, abort test and consider test as failed.

7.3.1.2. Manual Fault Isolation for ACU and Cabling. - Use the following procedure before replacing the ACU, Cable Driver, or cabling.

Materials Needed: A 2-foot test cable as described below.

Fabricate the test cable from RG-58/U coaxial cable. Install a TNC connector on one end of the cable. On the other end, solder a 78-ohm, 1/4 watt load resistor from the center conductor to shield. Also, solder a 0.1 mf, 50-V coupling capacitor to the center conductor.
Leave the other end of the capacitor free. On the cable end with the coupling capacitor and load resistor, peel back 2 inches of the braided shield, twist and solder an alligator clip to it.

Procedure:

1. Connect test cable TNC connector to output connector of Simulator.
2. Connect alligator clip to coax ground on Receiver.
3. Apply free end of capacitor to antenna input of Receiver.
4. Use scope to observe signal at TP1 in Receiver.
5. Perform certification test with capacitor connected as in step 3.
6. A good, clean LORAN-C modulated RF signal should periodically appear on TP1 during the test procedure.
7. If the signal appears, remove and replace Cable Driver.
8. Run Certification Test; if not good, remove and replace ACU.
9. If ACU is replaced, run certification test; if not good, check RF cabling and replace as necessary.

7.3.2 Clean-up Procedure.- Use the following procedure after replacing any assembly or component.

1. Apply power.
2. For failures that would not be detected by the background self test, i.e., EEPROM, Simulator and MCPU, run the Fault Isolation Test.
3. Perform System Turn-on/Check-out procedure (paragraph Table 3-2).
4. Perform Certification Test procedure (paragraph 6.2.2).
5. Verify that the system has acquired a signal and entered normal TRACKING mode.
6. Check system for proper operation (review Executive parameters).
7. Reinstall the LORAN-C Monitor System in rack and tidy up.

7.3.3 On-Site Removal/Replacement Procedures.- Reference LORAN-C Monitor Top and Bottom View Drawings in Section 11.

7.3.3.1. Top Cover Removal/Replacement.

Removal Procedure:

1. Slide the LORAN-C Monitor out on its rails until full access is gained to the top panel. Turn system power OFF.
2. Loosen nine slotted head captive fasteners on top panel.
3. Remove top panel.
4. Replacement is straightforward. Use the removal procedure in reverse.

7.3.3.2 Receiver Removal/Replacement.

Preparation: Remove power. Slide the LORAN-C Monitor chassis out on its rails. Then remove top panel (Paragraph 7.3.3.1). Disconnect the power connector, if necessary to gain proper clearance.

Removal Procedure:

1. At the Receiver BNC connector, remove the coaxial cable.
2. Loosen the jam nut holding the Receiver BNC connector to the rear of the LORAN-C Monitor.
3. Disconnect the ribbon cable connector from the header on the Receiver PCB.
4. Locate and identify the two captive screws securing the Receiver PCB in place.

NOTE

Each screw is held in place with a retaining ring on the bottom of the PCB. Each screw screws into a standoff.

5. Loosen the two captive screws.
6. Tilt the Receiver PCB. Then lift it up and out.

Replacement Procedure:

1. Replacement is straightforward. Use the removal procedure in reverse.
2. Be sure to reconnect any connectors on the rear of the LORAN-C Monitor chassis before reapplying power.

7.3.3.3. Simulator Removal/Replacement.

Preparation: Remove power; Then slide the LORAN-C Monitor chassis out on its rails. Disconnect the power connector, if necessary to gain proper clearance. Then tilt the LORAN-C Monitor up and back to gain access to the Simulator. Remove Lower Access panel.

Removal Procedure:

1. At the Simulator BNC connector, remove the coaxial cable.
2. Loosen the jam nut holding the Simulator BNC connector to the rear of the LORAN-C Monitor.
3. Disconnect the ribbon cable connector from the header on the Simulator PCB.
4. Locate and identify the two captive screws securing the Simulator PCB in place.

NOTE

Each screw is held in place with a retaining ring on the bottom of the PCB. Each screw screws into a standoff.

5. Loosen the two captive screws.
6. Tilt the Simulator PCB. Then lift it up and out.

Replacement Procedure:

1. Replacement is straightforward. Use the removal procedure in reverse.
2. Be sure to reconnect any connectors on the rear of the LORAN-C Monitor chassis before reapplying power.

7.3.3.4. LORAN-C Monitor Processor Removal/Replacement.

Preparation: Remove power. Slide the LORAN-C Monitor chassis out on its rails. Then remove top panel (Paragraph 7.3.3.1). Disconnect the power connector, if necessary to gain proper clearance.

Removal Procedure:

1. Remove connectors J1, J3, J4, J5, J6, J8, and J19. Remove the two retaining screws from the front panel IOT port, J2.
2. Locate and identify the five captive panel fasteners securing the Monitor Processor PCB.
3. Loosen five captive panel fasteners securing the Monitor Processor PCB.

NOTE

Once the five captive fasteners are released, the Monitor Processor board is held in place by three "snap-top" standoffs.

4. Remove the two retaining screws from the IOT DB-25 connector, J2.
5. Locate and identify the three snaptop standoffs.

CAUTION

In the next step, be careful to avoid applying too much pressure to the PCB. Excessive pressure may damage the board or its printed wiring.

NOTE

After the next step, the Monitor Processor PCB is still not ready for removal. The local terminal DB-25 connector still may impede removal.

6. Apply a slight upward pressure on the under side of the PCB in the vicinity of each standoff until the board "snaps" clear.
7. Gently tilt the front edge of the Monitor Processor PCB. At the same time, apply a slight side-to-side rocking motion to make sure that the back connector at the back edge comes clear.
8. Gently remove the Monitor Processor PCB.

Replacement Procedure:

1. Locate and identify the three snaptop standoffs.
2. Place the Monitor Processor PCB into position above the three snaptop standoffs.

3. Gently tilt the front edge of the Monitor Processor PCB. At the same time, apply a slight side-to-side rocking motion as you move the PCB into place to make sure that the connector at the back edge is positioned correctly.

CAUTION

In the next step, be careful to avoid applying too much pressure to the PCB. Excessive pressure may damage the board or its printed wiring.

4. Apply a slight downward pressure on the top side of the PCB in the vicinity of each standoff until the board "snaps" into place.

5. Locate and identify the five captive panel fasteners on the top surface of the Monitor Processor PCB.

6. Tighten the five captive panel fasteners to secure the Monitor Processor PCB into place.

7. Replace the two retaining screws for the IOT DB-25 connector, J2.

8. Reconnect connectors J3, J4, J5, J6, J8, J19, J1. Reinstall the two retaining screws to the front panel IOT RS-232 connector, J2.

9. Be sure to reconnect any connectors on the rear of the LORAN-C Monitor chassis before reapplying power.

7.3.3.4.1. EEPROM Modules Removal/Replacement.

Preparation: Remove power. Slide the LORAN-C Monitor chassis out on its rails. Then remove top panel (Paragraph 7.3.3.1). Disconnect the power connector, if necessary to gain proper clearance.

Removal/Replacement

Each EEPROM module is a standard PCB assembly. To remove it, simply exert a gentle pull straight up on the inside ends of the card ejectors. To replace, insert card into the slides and gently seat into the edge connector.

NOTE

In order to preserve averaged data correctly, reposition the EEPROM modules in the same respective locations when transferring EEPROM modules from one MCPU to another.

7.3.3.5. Power Supply/Battery Pack Removal/Replacement.

7.3.3.5.1 Power Supply Removal/Replacement.

Preparation: Remove power. Slide the LORAN-C Monitor chassis out on its rails. Then remove top panel (Paragraph 7.3.3.1). Disconnect the power connector, if necessary to gain proper clearance.

Removal Procedure:

1. Disconnect connectors J1 and J2.
2. Locate and identify the four captive panel fasteners securing the power supply assembly.
3. Loosen the four captive panel fasteners securing the power supply assembly.
4. Lift the power supply assembly straight up and out.

Replacement Procedure:

1. Replacement is straightforward. Use the removal procedure in reverse.
2. Be sure to reconnect any connectors on the rear of the LORAN-C Monitor chassis before reapplying power.

7.3.3.5.2. Battery Removal/Replacement.

Preparation: Remove power; then remove top panel (Paragraph 7.3.3.1).

Removal Procedure:

1. Use a 5/16-inch nut driver to loosen the two nuts which secure the battery mounting bracket into place.
2. Remove the two nuts and the lock washer holding each.
3. Remove the quick-connects from the battery terminals.
4. Remove the battery.

Replacement Procedure:

1. Replacement is straightforward. Use the removal procedure in reverse.
2. Be sure to reconnect any connectors on the rear of the LORAN-C Monitor chassis before reapplying power.

7.4. OFF-SITE CORRECTIVE MAINTENANCE.- Off-site corrective maintenance consists of fault isolation and removal/replacement procedures for components on the Monitor Processor and the power supply/Battery Pack.

7.4.1. Fault Isolation Procedures.

7.4.1.1. Description of the LORAN-C Processor Test.- This is a depot-level procedure. Reference LORAN-C Processor Logic Diagram and PCB Layout Drawing in Section 11. FEI document # 117AT003A may also be referenced for procedures and data recording sheets. The LORAN-C Monitor Production Test Program, Version 2.1, (herein referred to as the PTP) is firmware packaged in a set of 27256 EPROMs consisting of 2 devices. The PTP completely tests each functional block of the Monitor Processor board. The following functional blocks are tested:

- CPU
- Nonvolatile Memory (EEPROM)
- reset/system clock/wait state generator
- system configuration/front panel indicator
- LCD display
- interrupt controller
- internal/external communications, serial
- watchdog timer

The test is performed by placing the CPU board into a complete LORAN-C Monitor chassis. The test must be started with no EEPROM modules installed in the CPU. The user is prompted for all necessary inputs via the local terminal.

The PTP usually uses the Monitor's local terminal port for user interaction. In some instances, however, other system input devices are used. The local terminal permits test initiation and review. The tests are presented in a predetermined order; that is, the PTP's power supply test is the first of the sequence, and the watchdog timer test is the last. Each test isolates the fault to a functional entity. Each test ends with the instruction to "Perform manual fault isolation". The manual fault isolation typically involves simple point-to-point voltage/resistance checks of the circuits of the functional entity under test.

7.4.1.1.1 Power Supply Test.- During the Power Supply Test, the status bits from the power supply are tested. These bits represent the outputs ofthe comparators on the power supply which monitor the +5 volt, +15 volt, and battery voltage levels.

7.4.1.1.2 System ROM Test.- This test calculates a check sum on the ROMs in positions U3 and U5 on the CPU board.

7.4.1.1.3 RAM Test Description.- The PTP RAM test complements each word of the RAM, saves that result, then complements it back. It then compares the saved value to the complement of the value of the same word in the RAM. If the values are equal, the test decides that particular RAM work is working properly.The test applies the above process to all 8192 words in the two RAMs on the Monitor's CPU board. This test will continue looping and testing all 8192 words until the ENTER key is pressed on the local terminal. This allows time to perform the various oscilloscope checks described in the LORAN-C CPU functional checkout list.

7.4.1.1.4 System Configuration Dipswitch Tests.- The dipswitch test checks the small switches that are used to enter certain configuration parameters for the Monitor. The values of the switches are displayed on the local terminal in binary format, with a "1" meaning the switch is closed or "on," and a "0" meaning "off" or open. The user must verify the values on the local terminal by observing the physical positions of the switches. Whenever any of the switches change, the new values are printed on the terminal.

7.4.1.1.5 Front Panel LED Test, Description.- The front panel LED test that turns each of the four LEDs ON by themselves and tells the user via the terminal to verify that only the LED under test is lit. Then the user is instructed to press ENTER on the terminal.

7.4.1.1.6 LCD Display Test Description.- The LCD display test completely checks out the microprocessor-based DENSITRON LCD display on the front panel of the Monitor, as well as its associated DISPLAY SELECT pushbutton and debounce circuitry.

This test fills the display with ASCII characters in every possible position of the display (including some positions that are not seen except when the display "scrolls" those positions into view). After all locations have been filled with all the ASCII characters, the bottom line of the two-line display is blanked, and the top line is filled with "0". The user is prompted via the local terminal to press the DISPLAY SELECT switch twice. When the switch closes, an "X" replaces all the "0"s. When the switch is pressed again, the line is again filled with "0"s.

7.4.1.1.7. EEPROM Subsystem Test Description.- This test is very thorough. It tests each EEPROM slot in combination with the others with a complete check of each device in every configuration.

Each slot is tested against every other slot, with every device location of every slot tested.

7.4.1.1.8 Internal/External Communications (UART) Test Descriptions.- This test checks each of the three system UARTs. The UART's input is hooked to its output externally. Then the PTP sends and receives the full ASCII character set at every possible baud rate and data format. Parity, stop and start bit recognition are also tested.

The final circuit tested is the one which switches the output and input of the receiver/simulator UART between the connectors to the LORAN-C receiver and simulator.

In the case of the externally communicating UARTS, their associated RS 232-C drivers/receivers are included in the test loop.

7.4.1.1.9. System Real-Time Clock Functional Test Description.- This test is not meant to be extremely accurate; only to show that the 10 ms clock is indeed functional.

The 10-ms clock circuit interrupts the microprocessor every 10 ms to provide a real-time clock for the operating system. This test uses the LORAN-C Monitor's Operating System, MTOS, to measure 10 seconds of real-time and print messages on the Silent 700 to indicate when the interval begins and ends. The user is to use a stopwatch or wrist-watch to check the validity of the 10-second interval.

7.4.1.1.10 Watchdog Timer Test Description. - The watchdog timer test is deliberately last in the sequence because, if successful, it causes a system reset. During all the other tests, the timer is disabled, but now the user is instructed via the terminal to close the dipswitch that enables the timer. If the timer is operating correctly, the processor will reset continuously from that point on and no message is printed on the terminal. If the timer is not functional, a message to that effect is printed on the terminal.

7.4.1.2. Equipment and Materials Required- The following equipment and materials, or its equivalent is required for testing the LORAN-C Monitor Processor:

a. Equipment

1. DMM

2. Complete LORAN-C Monitor chassis, less the receiver and simulator assemblies.

3. Oscilloscope

4. LORAN-C Monitor Test Fixture

5. Stopwatch

b. Materials

1. 8 EEPROM modules fully populated with 8K devices.
2. Set of LORAN-C Monitor Test ROMs, Version 2.1.

7.4.1.3. Monitor Processor Test Procedure.- This procedure shall be performed on the CPU board with the nonvolatile memory modules removed. The functional blocks mentioned in the test titles correspond with the functional blocks contained in the Monitor Processor Detailed Block Diagram in SECTION 11.

7.4.1.3.1 Power Distribution Test.

1. Turn power to OFF. Install the Test ROMs, Version 2.1.

2. Use a multimeter for continuity testing and check for shorts between the following test points:

1.	TP1 to TP2	(+5 to +15)
2.	TP1 to TP3	(+5 to -15)
3.	TP1 to TP4	(+5 to GND)
4.	TP2 to TP3	(+15 to -15)
5.	TP2 to TP4	(+15 to GND)
6.	TP3 to TP4	(-15 to GND)

3. If a reading of 20 ohms or less is encountered, identify the cause and eliminate it. Repeat this step after any repairs are performed.

4. Adjust a triple output power supply to +5 VDC plus or minus 2%, +15 VDC plus or minus 2%, and -15 VDC plus or minus 2%.

5. Turn the supply OFF and connect it to the appropriate pins of the power supply connector on the CPU board.

6. Place the supply meters in current read-out mode or connect a current meter in line with the 5 VDC supply.

7. Turn the power supply ON and note the amount of current being drawn from the 5 VDC supply. Current drawn shall not be more than 3.0 A. If the current is greater than this amount, immediately remove power from the board and determine the cause of the excessive current. If necessary, perform the required repairs and begin this step again.

8. Connect the DMM ground lead to TP4. Check for the presence of the 5 VDC supply at the following locations:

U1, pins 33, 40
U2, pin 20
U3, pins 1, 28
U4, pin 14
U5, pins 1, 28
U6, pin 28
U7, pin 28
U8, pin 14
U9, pin 16
U10, pin 16
U11, pin 16
U12, pin 14
U13, pin 18
U14, pin 14
U15, pin 14
U16, pins 10, 13, 14
U17, pin 14
U18, pin 20
U19, pins 1, 13, 14
U20, pin 20

7.4.1.3.1 Power Distribution Test (cont.)

U21, pin 20
U22, pin 20
U23, pin 20
U24, pins 16, 28
U25, pin 16
U26, pins 6, 16
U27, pins 6, 16
U28, pin 16
U30, pin 16
U31, pin 27
U32, pin 27
U33, pin 14
U34, pin 27
U35, pin 16
U36, pin 16
U37, pin 16
U38, pin 16
U40, pin 14
U41, pin 16

Perform manual fault isolation.

9. Connect the DMM ground lead to TP4. Check for the presence of the 15 VDC supply at the following locations:

   U39, pin 14

   Perform manual fault isolation.

10. Connect the DMM ground lead to TP4. Check for the presence of the -15 VDC supply at the following location:
    U39, pin 1

    Perform manual fault isolation.

7.4.1.3.2. Clock Generator Test.

1. Connect the oscilloscope ground lead connected to TP4. Verify that a 5 MHz, 33% duty cycle square wave which is 5 Vs in amplitude appears at the following locations:

   U1, pin 19
   U8, pin 12

   Perform manual fault isolation.

2. Place DS1 switch 2 in the OFF position. Use the oscilloscope to verify that a logical LOW signal appears at the following locations, and, when the pushbutton S1 is pressed, that a logical HIGH level is present during the time that the button is held down:

   U13, pin 10
   U12, pins 2, 3, 4
   U1, pin 21
   U9, pin 15
   U10, pin 11
   U34, pin 23
   U31, pin 23
   U32, pin 23
   TP7

   Perform manual fault isolation.

3. Place DS1 Switch 2 in the ON position. Use the oscilloscope to verify that a logical LOW signal appears at the following locations, and, when the pushbutton S1 is pressed, that a logical HIGH level is present during the time that the button is held down:

   U11, pin 11

   Perform manual fault isolation.

4. Use an oscilloscope to verify that the following locations have an 8 MHz, 50% duty cycle square wave on them:

   J3-3
   J4-3

5. Use the oscilloscope to verify the presence of 100 Hz (10 msec period) square wave at the following location:

   U8, pin 3

   Perform manual fault isolation.

7.4.1.3.3 CPU RAM Test.

1. Turn the power supply OFF.

2. Make sure the local terminal is plugged into DB-25 connector P2 and DS1 Switch 2 is OFF. Set the terminal for 300 baud, 7 data bits, even parity, 1 stop bit. Connect the LORAN-C Monitor Test Fixture to the test bed.

3. Turn the power supply ON. This will start the test program, and you should see a message to that effect on the local terminal.

4. Execute a repetitious RAM test on the 16K of RAM resident on the target board. The test will exercise all locations of the scratchpad RAM.

5. Upon successful completion of each iteration of the RAM test, a message indicating that the test was successful will appear on the screen of the local terminal.

   Perform manual fault isolation.

NOTE

Do not stop the RAM test at this time. The next step tests the CPU logic levels. You will then stop the RAM test.

NOTE

Valid logic levels for this test are:

≤0.7 VDC (LO); ≥ 2.7 VDC (HI)

6. During successful execution of the RAM test, use the oscilloscope to verify that the voltage levels at the following locations are valid logic levels, with no indeterminate levels:

   U1, pins 2 through 18, and pins 21 through 39

7. Stop the RAM test upon successful completion of this step.

   Perform manual fault isolation.

7.4.1.3.4 ROM Test.

1. Execute a ROM test on the program memory resident on target board.

2. Upon successful completion of each iteration of the ROM test, a message indicating that the test was successful will appear on the screen of the local terminal.

   Perform manual fault isolation.

7.4.1.3.5 Wait State Generator Test.

1. Connect channel 1 of the oscilloscope to U1 pin 19 (system clock) and channel 2 to U15 pin 2 (NVCE). Ground the scope probes at TP4.
2. Initiate execution of the EEPROM test via the IOT.
3. Set channel 2 triggering on a falling edge.
4. Verify that there are at least 2 clock cycles displayed on channel 1 within the active low region of the channel 2 signal.
5. Connect channel 1 of the oscilloscope to U1 pin 19 (system clock) and channel 2 to U15 pin 1 (CE7). Ground the scope probes at TP4.
6. Initiate execution of the Front Panel LCD test via the IOT.
7. Set channel 1 triggering on a falling edge.
8. Verify that there are at least 6 clock cycles displayed on channel 1 within the active low region of the channel 2 signal.

Perform manual fault isolation.

7.4.1.3.6 EEPROM Read/Write Test.- This test requires the following materials:

- 8 EEPROM modules fully populated with 8K devices.

1. Verify that DS1 switch 1 is ON.
2. Install one EEPROM module into each slot on the CPU board.
3. Initiate the EEPROM test program by pressing <ENTER> on the terminal.
4. Upon successful completion of the test of each device, a pass/fail status message will appear on the local terminal screen. Complete each step until prompted that the test is complete.

Perform manual fault isolation.

7.4.1.3.7 System Configuration/Front Panel Indicator Functional Block Test.

1. Set DS1 switches 3 through 8 to OFF.
2. Initiate the DIP switch test by pressing 4 and <ENTER> on the terminal.

3. Using the local terminal display, verify that no interaction occurs when each of the above-mentioned DIP switches is set to the ON position individually. On the local terminal, a zero corresponding to a switch number indicates that the switch is OFF. A 1 indicates that the switch is ON. Only the switch number corresponding to the switch that is set to the ON position should display a 1 during the test.

   Perform manual fault isolation.

4. Initiate number 5, FRONT PANEL LED TEST; press <ENTER> on the terminal.

5. Verify that all the LEDs on the fixture are illuminated.

   Perform manual fault isolation.

6. Press <ENTER> on the terminal to continue the test.

7. Verify that only the ACQUISITION LED is extinguished.

   Perform manual fault isolation.

8. Press <ENTER> on the terminal to continue the test.

9. Verify that only the TRACKING LED is extinguished.

   Perform manual fault isolation.

10. Press <ENTER> on the terminal to continue the test.

11. Verify that only the ALARM LED is extinguished.

    Perform manual fault isolation.

12. Press <ENTER> on the terminal to continue the test.

13. Verify that only the NORMAL LED is extinguished.

    Perform manual fault isolation.

7.4.1.3.8 LCD Display Functional Block Test.

1. Select item 6 from the menu and press <ENTER> on the terminal to start the LCD test. The LCD display should now show each character position being cycled through the ASCII character set.

2. Wait until the test is finished.

3. View the display with a line of sight perpendicular to its face and adjust VR1 for optimum contrast and readability of the display.

4. Follow the prompts on local terminal screen to test the DISPLAY SELECT switch.

Perform manual fault isolation.

7.4.1.3.9 UART Test.

1. Use the oscilloscope to verify that a 2.4576 MHz square wave appears at the following locations:

U31, pin 13
U32, pin 13
U34, pin 21
U10, pin 10
TP6

Perform manual fault isolation.

2. Select item 9 on the menu and press <ENTER> on the terminal to start the internal communications tests. Follow the prompts on the local terminal to complete the test.

Perform manual fault isolation.

7.4.1.3.10 10-msec Interrupt Functional Block Test.

1. Select item 8 from the menu. Follow the prompts on the local terminal to complete the test.

Perform manual fault isolation.

7.4.1.3.11 Watchdog Timer Functional Block Test.

1. Select item 10 on the local terminal and press <ENTER> to start the watchdog test.

2. When prompted by the local terminal, switch DS1 switch 2 to ON.

3. Use an oscilloscope to verify the presence of a 4.7 Hz (213 msec period) square wave at the following location:

U12, pin 3

4. If the watchdog timer is malfunctioning, the terminal will show

! ! WATCHDOG TIMER FAILED ! !

5. Switch DS1 switch 2 to the OFF position.

Perform manual fault isolation.

This concludes the Monitor Processor test.

7.4.1.4. Troubleshooting the Power Supply.- Reference LORAN-C Monitor Power supply Schematic Diagram and PCB Layout Drawing in Section 11. FEI document # 117AT003A may also be referenced for procedures and data recording sheets.

7.4.1.4.1. Tools and Equipment Required.

1. Digital Multimeter
2. Power supply Load Box. The power supply load box must be capable of placing switch-selectable loads on the power supply. Test loads for each of the power supplies are described below.

7.4.1.4.2 Test Load for 5 V Power Supply. For the 5 V power supply, you should be able to increase the load in 0.5 A increments to a maximum of 2.0 A.

7.4.1.4.3. Test Load for +15 V Power Supply. For the +15 V power supply, you should be able to increase the load in 100 mA increments to a maximum of 500 mA.

7.4.1.4.4. Test Load for -15-V Power Supply. For the -15-V power supply, you should be able to increase the load in 100 mA increments to a maximum of 500 mA.

7.4.1.4.5. Load Test for 5 V Power Supply.- Use the following procedure to load-test the 5 V power supply.

1. Remove all external connections from power supply.
2. Connect load box to 5 V power supply and ground.
3. Increase the load in 0.5 A increments to a maximum of 2.0 A, while monitoring voltage at 5 V power supply terminal.
4. When the full load of 2.0 A is applied, the terminal voltage should be 5.1 V, +/-0.05 V. At no time should the voltage vary more than +/-0.05 V.

7.4.1.4 6. Load Test for +15 V Power Supply.- Use the following procedure to load-test the +15 V power supply.

NOTE

During steps 5 and 6, maintain the 2.0 A load on the 5 V Power Supply.

1. Remove all external connections from power supply.
2. Connect load box across terminals of 5 V power supply.
3. Adjust 5 V power supply load for maximum load of 2.0 A.
4. Connect load box to +15 V power supply and ground.

5. Increase the load on the +15 V power supply in 100 mA increments to a maximum of 500 mA, while monitoring Vage at +15 V power supply terminal.

6. When the full load of 500 mA is applied, the terminal voltage should be +15.0 V, +/-.50 V. At no time should the voltage vary more than +/-.50 V.

7.4.1.4.7. Load Test for -15 V Power Supply.- Use the following procedure to load-test the -15 V power supply.

NOTE

During steps 5 and 6, maintain the 2.0 A load on the 5 V Power Supply.

1. Remove all external connections from power supply.
2. Connect load box across terminals of 5 V power supply.
3. Adjust 5 V power supply load for maximum load of 2.0 A.
4. Connect load box to -15 V power supply and ground.
5. Increase the load on the -15 V power supply in 100 mA increments to a maximum of 500 mA, while monitoring voltage at -15 V power supply terminal.
6. When the full load of 500 mA is applied, the terminal voltage should be -15.0 V, +/-0.50 V. At no time should the voltage vary more than +/-0-.50 V.

7.4.1.4.8. Power Supply Troubleshooting Procedure..- Use the procedure presented in table 7-2 for troubleshooting the power supply. After the fault has been isolated and corrected, perform the power supply load tests (paragraphs 7.4.1.4.5 through 7.4.1.4.7).

Table 7-2. Power Supply Troubleshooting Procedure

Malfunction	Test or Inspection	Corrective Action
A. ZERO OUTPUT FOR ANY OF THE THREE POWER SUPPLIES		
	1. Measure for 28 VDC +/- 2 VDC at TP1 and Vin (pin 4) of the DC/DC converter.	
		If OK, remove/replace the DC/DC converter.

2. Measure for 24 VAC +/- 2 VAC between T1P1 and T1P3 and between pins 6 and 7 of J2.

    If OK, replace the rectifier diodes D4,D5,D6, and D7. If not OK, remove/replace the transformer.

B. OUTPUT FOR ANY OF THE THREE POWER SUPPLIES IS HIGH OR LOW

1. Perform point-to-point voltage and resistance checks.

    Remove/replace defective components. If none found, remove/replace DC/DC converter module.

C. POWER SUPPLY UNABLE TO KEEP BATTERIES CHARGED

1. Check relay K1 for sticking contacts.

    Remove/replace Relay K1.

2. Check charging supply voltage for 38 VDC +/- 5VDC at TP10.

    If not OK, proceed to next step.

3. Check AC voltage for 30 VAC +/- 4 VAC at pins 5 and 8 of charging supply transformer T1.

    If not OK, remove/replace charging supply transformer T1.

    If OK, check rectifiers D11, D12, and remove/replace as necessary.

4. To check transistor Q2 use the IN-CIRCUIT DIODE CHECK feature of the DMM. Check emitter/base and base/collector junctions.

    If OK, remove/replace semiconductor device U1, or else remove/replace Q2, as needed.

7.4.2 Removal/Replacement of Replaceable Components.

7.4.2.1. LORAN-C Processor.- All components of the LORAN-C Monitor Processor are removable by utilizing standard shop practices. No special tools or skills are required.

7.4.2.2. Power Supply.- Only the transformer is included here. All other components of the power supply are removable by utilizing standard shop practices. No special tools or skills are required.

7.4.2.2.1. Transformer Removal/Replacement.

Preparation: Remove power. Slide the LORAN-C Monitor chassis out on its rails. Then remove top panel (Paragraph 7.3.3.1). Disconnect the power connector, if necessary, to gain proper clearance.

Removal Procedure:

1. Disconnect the transformer by disconnecting the four quick-disconnects.
2. Use a 5/16-inch nut driver to loosen the two nuts which secure the transformer into place.
3. Remove the two nuts and the lock washer holding each.
4. Remove the transformer.

Replacement Procedure:

1. Replacement is straightforward. Use the removal procedure in reverse.
2. Be sure to reconnect any connectors on the rear of the LORAN-C Monitor chassis before reapplying power.

7.4.2.3. Front Panel Assembly Removal/Replacement.- This paragraph covers removal of the front panel assembly. Once the front panel assembly is removed, all components of the front panel assembly are removable by utilizing standard shop practices. No special tools or skills are required.

Preparation: Remove power.

Removal Procedure:

1. Remove quick-disconnects from rocker switch.
2. Remove ribbon cable from Monitor Processor.
3. Remove LED interface cable from Monitor Processor.
4. Remove quick-disconnects from fuse holder.

7.4.2.4. Front Panel LCD Display Removal/Replacement.

Preparation: Remove power; then remove top panel (Paragraph 7.3.3.1). Remove front panel (paragraph 7.4.2.3).

Removal Procedure:

1. Disconnect ribbon cable connectors.
2. Remove four number 4 screws, four flat washers and four lock washers.

3. Remove the LCD display.

Replacement Procedure:

CAUTION

> When replacing the LCD display, be careful when installing screws. Avoid exerting too much pressure when installing screws. The LCD display is fragile; too much pressure can damage it.

Replacement is straightforward. Use the removal procedure in reverse.

7.4.2.5. Antenna Cable Driver Removal/Replacement.

Preparation: Remove power.

Removal Procedure:

1. Disconnect the two-conductor power cable from the CPU board.
2. Use a 5/16-inch nut driver to loosen the two nuts which secure the Antenna Line Driver in place.
3. Remove the two nuts and the lock washer holding each.
4. Remove the Antenna Line Driver.

Replacement Procedure:

1. Replacement is straightforward. Use the removal procedure in reverse.
2. Be sure to reconnect any connectors on the rear of the LORAN-C Monitor chassis before reapplying power.

7.5 OVERHAUL MAINTENANCE AND REPAIR STANDARDS.- None of the maintenance tasks for the LORAN-C Monitor require the facilities of a depot repair station. Therefore, this section is not applicable to the LORAN-C Monitor.

7.6. REMOVAL AND PACKING INSTRUCTIONS.

7.6.1. REMOVING THE LORAN-C Monitor From Its Rack.

Preparation: Remove power.

Removal Procedure:

1. Slide the LORAN-C Monitor out on its rails until the rail latches on both sides to prevent any further removal.

NOTE

In the following steps, it may be necessary to tilt the LORAN-C Monitor slightly upward and to move it from side to side to gain access to connectors.

2. At the rear of the LORAN-C Monitor, carefully disconnect the system power cable, the FCPU RS-232 connector, and the two coaxial connectors.

3. Locate and identify the rail latches on either side of the LORAN-C Monitor.

4. Depress both rail latches and gently move the LORAN-C Monitor backward to remove.

7.6.2. Packing Instructions.- During the following procedure, use the shipping container and packing materials in which the LORAN-C Monitor was originally shipped.

1. Place the LORAN-C Monitor in the shipping container, with the bottom half of the form-fit foam cushion in the bottom.

2. Carefully fit the form-fit top over the LORAN-C Monitor and fold the antistatic wrap into place.

3. Seal the shipping container.

SECTION 8 - PARTS LIST

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER SMR CODE	IND	REFERENCE SYMBOL NUMBER NATIONAL STOCK-NUMBER	ITEM NAME ITEM AND LOT NO	 FEDERAL MFG CODE	PRIME CONTRACTORS PART NUMBER MANUFACTURERS NUMBER	LONG NO CODE	QTY PER ASSY RECOM MAINT FACTOR	QTY PER UNIT RECOM OVERH FACTOR	QTY PER EA USABLE ON CODE	SHELF LIFE OPTIONAL REP / LL	TOTAL RECOM ORDERED PP / QTY	UNIT PRICE SPARES ALLOCATION	EXTENDED UNIT PRICE	REMARKS
0001 M	A		ASSY, SHIPPABLE LORAN C MONITOR	63812	000705		REF	REF	REF	IND		26,600E 112		
0002	B		ASSY, LORAN C MONITOR	63812	000700		1	1	1	IND R 1	X	12,428P 112		
0003	C		CHASSIS, ASSY	63812	000760-1		1	1	1	IND R 1	X	237.00E 112		
0004 M	C		PC ASSY, POWER SUPPLY	63812	000750-1		1 002C	1	1	IND R 1	X	750.00E 112		
0005	D		PWR SUPPLY PCB	63812	000757-1		1 002C	1	1	IND 1	X	127.36E 112		
0006	D		CAPACITOR	56289	601D278C050IT2		1 131C	1	1	IND		8.97E 112		
0007	D		CAPACITOR	81349	M39014/01-1554		1 002C	1	46	IND		1.03E 8153		
0008D	D		CAPACITOR	81349	M39006/09-5616		1 10	1	1	IND		0.43E 112		
0009	D		CAPACITOR	81349	M39006/22-0650		1 10	1	1	IND		33.76E 112		

CONTRACT NUMBER DTFA01-87-C-00006 NOMENCLATURE MONITOR SYSTEM, LORAN C MODEL/TYPE NO. LX-10332

CONTRACTOR FRONTIER ENGINEERING, INC. DATE OF LIST MAY 30, 1989 REVISION B PAGE 1 OF 27

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	IND	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTOR PART NUMBER	ONG NO CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LL	PP / QTY	SPARES ALLOCATION		
0010	D		DIODE				5	5	5	IND		4.05E		
				81349	JANTX1N5550		9C					560		
0011	D		DIODE				3	3	4	IND		1.85E		
				81349	JANTX1N3611		5C					448		
0012	D		DIODE				1	1	1	IND		6.02E		
				81349	JANTX1N4572		004C					112		
0013	D		DIODE				1	1	3	IND		.66E		
				81349	JANTX1N483B		000C					336		
0014	D		HEADER, 6 POS				1	1	2	IND		4.24E		
				O4618	350431-2		1C					224		
0015	D		HEADER, 9 POS				1	1	1	IND		5.57E		
				O4618	350432-2		1C					112		
0016	D		RELAY				1	1	1	IND		5.81E		
				98925	MT2-23V-C93403		101C					112		
0017D SEE 0059	D		TRANSISTOR				1	1	7	IND		1.26E		
				81349	JANTX2N2222A		002C					784		
0018	D		TRANSISTOR				1	1	1	IND		14.81E		
				81349	JANTX2N3868		003C					112		
0019D	D		RESISTOR				1	1	1	IND		.24E		
				81349	RLR07C2003FS		000C					112		

CONTRACT NUMBER: DTFA01-87-C-00006 NOMENCLATURE: MONITOR SYSTEM, LORAN C MODEL/TYPE NO.: FA-10232

CONTRACTOR: FRONTIER ENGINEERING, INC DATE OF LIST: MAY 30, 1989 REVISION: B

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	IND	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTOR PART NUMBER	ONG NO CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LL	PP / QTY	SPARES ALLOCATION		
0019A	D		RESISTOR	81349	RLR07C10R0FS		2 000C	2	2	IND		24E		
0019B	D		RESISTOR	81349	RLR07C1103FR		2 000C	2	2	IND		24E		
0019C	D		RESISTOR	81349	RLR07C1002FR		1 000C	1	1	IND		24E		
0019E	D		RESISTOR	81349	RLR07C4322FS		1 000C	1	1	IND		52E		
0019F	D		RESISTOR	81349	RLR07C5111FS		1 000C	1	1	IND		52E		
0019G	D		RESISTOR	81349	RLR07C1001FR		2 000C	2	2	IND		24E		
0019H	D		RESISTOR	81349	RLR07C5112FR		1 000C	1	1	IND		52E		
0019I	D		RESISTOR	81349	RLR07C1213FS		1 000C	1	1	IND		24E		
0019J	D		RESISTOR	81349	RLR07C1503FR		1 000C	1	1	IND		24E		

CONTRACT NUMBER DTFA01 87 C 00006 NOMENCLATURE MONITOR SYSTEM, LORAN C MODEL/TYPE NO FA 10232

CONTRACTOR FRONTIER ENGINEERING, INC DATE OF LIST MAY 30 1989 REVISION B

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	I N D	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTOR PART NUMBER	LONG NO. CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO.	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LL	PP / QTY	SPARES ALLOCATION		
0019K	D		RESISTOR	81349	RLR07C2001FR		1 000C	1	1	IND		.24E		
0019L	D		RESISTOR	81349	RLR07C3922FS		1 000C	1	1	IND		.52E		
0019N	D		RESISTOR	81349	RLR07C2742FS		1 000C	1	1	IND		.24E		
0019O	D		RESISTOR	81349	RLR07C6042FR		1 000C	1	1	IND		.24E		
0020	D		VARISTOR	59756	S20K150		1 007C	1	1	IND		.90E 112		
0021	D		TERMINAL	18310	10-201-2-01		11 000C	11	16	IND		.08E 1792		
0022	D		HEATSINK	O5820	204CB		1 000C	1	.7	IND		.71E 112		
0023	D		IC	50507	UC2906J		1 192C	1	1	IND		10.55E 112		
0024 M	D		IC	81349	M38510/11201BCX		1 088C	1	1	IND		9.48E 112		REVISED PER APPROVED ECR #0016

CONTRACT NUMBER: DTFA01-87-C-00006
NOMENCLATURE: MONITOR SYSTEM, LORAN C
MODEL/TYPE NO.: FA-10232
CONTRACTOR: FRONTIER ENGINEERING, INC.
DATE OF LIST: MARCH 14, 1990
REVISION: B2

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	I N D	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTOR PART NUMBER	CONC CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHI FACTOR	USABLE ON CODE	OPTIONAL REP / LL	 PP / QTY	SPARES ALLOCATION		
0025 M	D		IC				1	1	1	IND		218.99E		
				72347	PKA2232P		368C					112		
0026	D		TRANSFORMER				1	1	1	IND		9.29E		
				O8779	ST4-48		388C					112		
0027	D		POTENTIOMETER				2	2	2	IND		2.61E		
				56699	8024EJW103		760C					224		
0028D	D		RESISTOR				1	1	1	IND		.24E		
				81349	RLR07C4702FR		000C					112		
0028A	D		RESISTOR				1	1	1	IND		.24E		
				81349	RLR07C8662FS		000C							
0029D	D		RESISTOR				1	1	1	IND		.52E		
				81349	RLR07C4751FS		000C					112		
0030D	D		RESISTOR				1	1	1	IND		.24E		
				81349	RLR07C5R00FR		000C					112		
0031D SEE 0019B	D		RESISTOR				2	2	2	IND		.24E		
				81349	RLR07C1103FR		000C					224		
0031A	D		BRACKET, POWER SUPPLY				1	1	1	IND		7.16E		
				63812	000860-1									

CONTRACT NUMBER: DTFA01-87-C-00006 NOMENCLATURE: MONITOR SYSTEM, LORAN C MODEL/TYPE NO.: FA-10232
CONTRACTOR: FRONTIER ENGINEERING, INC. DATE OF LIST: MAY 30, 1989 REVISION: B PAGE 5 OF 27

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	IND	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTOR PART NUMBER	LONG NO CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO.	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LI.	PP / QTY	SPARES ALLOCATION		
0032D SEE0019C	D		RESISTOR	81349	RLR07C1002FR		1 000C	1	1	IND		.24E 112		
0033D SEE 0019E	D		RESISTOR	81349	RLR07C4322FS		1 000C	1	1	IND		.52E 112		
0034D SEE 0019F	D		RESISTOR	81349	RLR07C5111FS		1 000C	1	1	IND		.52E 112		
0035D SEE 0019G	D		RESISTOR	81349	RLR07C1001FR		2 000C	2	2	IND		.24E 224		
0036D SEE 0019H	D		RESISTOR	81349	RLR07C5112FR		1 000C	1	1	IND		.24E 112		
0036A	D		CLIP , COMPONENT	O6915	V 1010		1 000C	1	1	IND		0.70E		
0037D SEE 0019I	D		RESISTOR	81349	RLR07C1213FS		1 000C	1	1	IND		.24E 112		
0037A	D		RESISTOR	81349	RLR07C6652FS		2 000C	2	2	IND		.24E		
0038D SEE 019J	D		RESISTOR	81349	RLR07C1503FR		1 000C	1	1	IND		.24E 112		

CONTRACT NUMBER: DTFA01-87-C-00006 NOMENCLATURE: MONITOR SYSTEM, LORAN C MODEL/TYPE NO.: FA-10232

CONTRACTOR: FRONTIER ENGINEERING, INC. DATE OF LIST: MAY 30, 1989 REVISION: B

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	IND	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTORS PART NUMBER	LONG NO CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LL	 PP / QTY	SPARES ALLOCATION		
0038A	D		RESISTOR	19701	RN60D3321F		1 000C	1	1	IND		20E		
0039D SEE 0019K	D		RESISTOR	81349	RLR07C2001FR		1 000C	1	1	IND		24E 112		
0039A	D		RESISTOR	81349	RLR07C1502FS		1 000C	1	1	IND		24E		
0040D SEE 0019L	D		RESISTOR	81349	RLR07C3922FS		1 000C	1	1	IND		52E 112		
0041D	D		RESISTOR	81349	RLR07C2722FS		1 000C	1	1	IND		24E 112		
0042D SEE 0019O	D		RESISTOR	81349	RLR07C6042FR		1 000C	1	1	IND		24E 112		
0043	C		AC PWR XFRMR	08779	241-7-20		1 400C	1	1	IND		18.08E 112		
0044	C		CPU MODULE	63812	000720-1		1 183C	1	1	IND R 1	X	1750.00E 112		
0045 M	D		PC BOARD, CPU	63812	000722-1		1 000C	1	1	IND 1	X	711.71E 112		

CONTRACT NUMBER: DTFA01-87-C-00006 NOMENCLATURE: MONITOR SYSTEM, LORAN C MODEL/TYPE NO.: FA 10232
CONTRACTOR: FRONTIER ENGINEERING, INC DATE OF LIST: MAY 30, 1989 REVISION: B PAGE 7 OF 27

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER SMR CODE	IND	REFERENCE SYMBOL NUMBER NATIONAL STOCK NUMBER	ITEM NAME ITEM AND LOT NO	 FEDERAL MFG CODE	PRIME CONTRACTOR PART NUMBER MANUFACTURERS NUMBER	LONG NO.	QTY PER ASSY RECOM MAINT FACTOR	QTY PER UNIT RECOM OVERHL FACTOR	QTY PER EA USABLE ON CODE	SHELF LIFE OPTIONAL REP / LL	TOTAL RECOM ORDERED PP / QTY	UNIT PRICE SPARES ALLOCATION	EXTENDED UNIT PRICE	REMARKS
0046	D		CAPACITOR	81349	SAME AS 0007 M39014/01-1554		40 0007C	REF	REF	IND		1.04E		
0047	D		CAPACITOR	81349	M39014/01-1309		6 000C	6	6	IND		.71E 672		
0048	D		DIODE	81349	SAME AS 0013 JANTX1N483B		2 000C	REF	REF	IND		.66E		
0049	D		DIP SWITCH	81349	M83504/02-028		1 008C	1	1	IND		2.35E 112		
0050	D		RELAY	61725	MT2-5V-C93401		2 359C	2	2	IND		5.33E 336		
0051 M	D		HEADER, 6 POS	O4618	SAME AS 0014 350431-2		1 1C	REF	REF	IND		4.24E		
0052	D		CONNECTOR	81349	M24308/23-33		1 002C	1	1	IND		43.02E 112		
0053	D		HEADER, 50 POS	81349	M83503/25-22		2 0004C	2	2	IND		16.26E 224		
0054	D		HEADER, 14 POS	81349	M83503/25-04		2 003C	2	2	IND		6.99E 224		

CONTRACT NUMBER: DTFA01-87-C-00006 NOMENCLATURE: MONITOR SYSTEM, LORAN C MODEL/TYPE NO.: FA-10232
CONTRACTOR: FRONTIER ENGINEERING, INC. DATE OF LIST: MAY 30, 1989 REVISION: B

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	IND	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTOR PART NUMBER	LONG NO. CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO.	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LL	PP / QTY	SPARES ALLOCATION		
0055	D		HEADER, 10 POS				1	1	1	IND		5.93E		
				81349	M83503/25-01		002C					112		
0056	D		CONN, 44 POS				9	9	9	IND		19.67E		
				81349	M21097/21-172		002C					112		
0057	D		HEADER, 2 POS				1	1	1	IND		1.78E		
				04618	350428-2		084C					112		
0058	D		KEY				9	9	9	IND		.17E		
				97137	009-00473-9		000C					896		
0059	D		TRANSISTOR		SAME AS 0017D		5	5	5	IND		1.26E		
				81349	JANTX2N2222A		002C					784		
0060	D		RESISTOR				4	4	4	IND		.24E		
				81349	RLR07C1002GR		000C					448		
0061	D		RESISTOR				1	1	1	IND		.24E		
				81349	RLR07C1003GR		000C					112		
0062	D		RESISTOR				9	9	9	IND		.24E		
				81349	RLR07C3010GR		002C					1120		
0063D	D		RESISTOR				1	1	1	IND		.24E		
				81349	RLR07C7872GR		009C					112		

CONTRACT NUMBER: DTFA01-87-C-00006 NOMENCLATURE: MONITOR SYSTEM, LORAN C MODEL/TYPE NO.: FA-10232
CONTRACTOR: FRONTIER ENGINEERING, INC. DATE OF LIST: MAY 30, 1989 REVISION: B

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER SMR CODE	IND	REFERENCE SYMBOL NUMBER NATIONAL STOCK NUMBER	ITEM NAME ITEM AND LOT NO.	FEDERAL MFG CODE	PRIME CONTRACTORS PART NUMBER MANUFACTURERS NUMBER	LONG NO CODE	QTY PER ASSY RECOM MAINT FACTOR	QTY PER UNIT RECOM OVERHL FACTOR	QTY PER EA USABLE ON CODE	SHELF LIFE OPTIONAL REP / LL	TOTAL RECOM ORDERED PP / QTY	UNIT PRICE SPARES ALLOCATION	EXTENDED UNIT PRICE	REMARKS
0063A	D		RESISTOR	81349	SAME AS 0039A RLR07C1502FS		1 000C	REF	REF	IND		.24E		
0064	D		RESISTOR PACK	81349	M8340105M1002XC		2 009C	2	2	IND		2.20E 112		
0065D	D		RESISTOR PACK	81349	M8340105M2200XC		1 007C	1	1	IND		2.37E 112		
0066	D		TERMINAL	18310	SAME AS 0021 10-201-2-01		2 000C	REF	REF	IND		.08E		
0067 M	D		IC	34649	MD80C88/B		1 323C	1	1	IND		160.00E 112		
0068	D		IC	81349	M38510/38201BRA		3 060C	3	3	IND		28.53E 336		
0068A	D		ASSY, EPROM, PROGRAM	63812	000816-1		1 191C	1	1	IND R L	X	325.00E		
0069	E		IC	81349	M38510/22401BYA		1 191C	1	2	IND		43.07E 112		
0069A	E		LABEL, STICK-ON		AVY S-816		1 000C	4	1	IND		0.50E		

CONTRACT NUMBER: DTFA01-87-C-00006	NOMENCLATURE: MONITOR SYSTEM, LORAN C	MODEL/TYPE NO.: FA-10232	
CONTRACTOR: FRONTIER ENGINEERING, INC.	DATE OF LIST: MAY 30, 1989	REVISION: B	PAGE 10 OF 27

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER SMR CODE	IND	REFERENCE SYMBOL NUMBER NATIONAL STOCK NUMBER	ITEM NAME ITEM AND LOT NO.	FEDERAL MFG CODE	PRIME CONTRACTORS PART NUMBER MANUFACTURERS NUMBER	LONG NO. CODE	QTY PER ASSY RECOM MAINT FACTOR	QTY PER UNIT RECOM OVERHL FACTOR	QTY PER EA USABLE ON CODE	SHELF LIFE OPTIONAL REP / LL	TOTAL RECOM ORDERED OPTIONAL PP / QTY	UNIT PRICE SPARES ALLOCATION	EXTENDED UNIT PRICE	REMARKS
0070 M	D		IC	34371	HM1-65642C/883		2 097C	2	2	IND		66.36E 224		
0071	D		IC	81349	M38510/31004BCX		2 020C	2	2	IND		1.82E 224		
0072	D		IC	81349	M38510/05602BEX		1 020C	1	1	IND		12.80E 112		
0073	D		IC	14933	8500301EX		2 040C	2	2	IND		6.35E 224		
0074	D		IC	81349	M38510/30501BCX		2 020C	2	2	IND		1.82E 224		
0075	D		IC	14933	8406801VA		1 039C	1	1	IND		57.19E 112		
0076 M	D		IC	81349	M38510/30003BCX		2 020C	2	2	IND		1.82E 224		
0077D	D		IC	81349	M38510/30102BCX		2 022C	2	2	IND		1.82E 224		
0077A	D		IC	14933	8405601CX		2 039C	2	2	IND		5.00E		

CONTRACT NUMBER: DTFA01-87-C-00006 NOMENCLATURE: MONITOR SYSTEM, LORAN C MODEL/TYPE NO.: FA-10232
CONTRACTOR: FRONTIER ENGINEERING, INC DATE OF LIST: MAY 30, 1989 REVISION: B PAGE 11 OF 27

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	I N D	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTORS PART NUMBER	LONG NO. CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LL	PP / QTY	SPARES ALLOCATION		
0078	D		IC	14933	8601201CX		1 040C	1	1	IND		10.07E 112		
0079	D		IC	81349	M38510/32403BRX		2 033C	2	2	IND		4.03E 224		
0080	D		IC	81349	M38510/32803BRX		1 020C	1	1	IND		5.29E 112		
0081	D		IC	14933	8501601YA		1 076C	1	1	IND		64.65E 112		
0082	D		IC	81349	M38510/30903BEX		3 040C	3	3	IND		2.01E 336		
0083	D		IC	81349	M38510/30701BEX		3 039C	3	3	IND		3.32E 336		
0084	D		IC	14933	8501501XA		3 233C	3	3	IND		75.34E 336		
0085	D		IC	81349	M38510/30702BEX		4 053C	4	4	IND		2.61E 448		
0086	D		IC	O4713	1488/BCXJC		1 205C	1	1	IND		2.32E 112		

CONTRACT NUMBER: DTFA01-87-C-00006 NOMENCLATURE: MONITOR SYSTEM, LORAN C MODEL/TYPE NO.: FA-10232
CONTRACTOR: FRONTIER ENGINEERING, INC. DATE OF LIST: MAY 30, 1989 REVISION: B

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	I N D	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTORS PART NUMBER	LONG NO CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO.	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LL	PP / QTY	SPARES ALLOCATION		
0087	D		IC	04713	1489A/BCXJC		1 126C	1	1	IND		2.32E 112		
0088	D		OSCILLATOR	54331	7401B		1 097C	1	1	IND		144.00E 112		
0089	D		CRYSTAL	31649	MP1-15MHZ		1 004C	1	1	IND		1.59E 112		
0090	D		CRYSTAL	31649	MP1-2.4576MHZ		1 063C	1	1	IND		2.87E 112		
0091	D		POTENTIOMETER	56699	SAME AS 0027 8024EJW103		1 760C	REF	REF	IND		2.61E		
0092	D		CARD GUIDE	32559	VG1-2		18 000C	18	18	IND		.73E 1792		
0093	D		IC SOCKET	91506	840-AG11D		1 000C	1	1	IND		5.19E 112		
0094	D		IC SOCKET	91506	828-AG11D		2 000C	2	2	IND		3.81E 224		
0095	D		PCB FASTENER	46384	PEK-632-40		5 000C	5	5	IND		1.45E 112		

CONTRACT NUMBER: DTFA01-87-C-00006	NOMENCLATURE: MONITOR SYSTEM, LORAN C	MODEL/TYPE NO: FA-10232	
CONTRACTOR: FRONTIER ENGINEERING, INC	DATE OF LIST: MAY 30, 1989	REVISION: B	PAGE 13 OF 27

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR UNIT NOMENCLATURE   LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	IND	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTORS PART NUMBER	LONG NO CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL		SPARES ALLOCATION		
										REP / LL	PP / QTY			
0096	D		SWITCH, PB	95146	TPA11CG-PC 0		1 000C	1	1	IND		3.18E 112		
0097	D		CAPACITOR	81349	M39014/01-1206		4 000C	4	4	IND		1.30E 448		
0097A	D		RESISTOR	81349	SAME AS 0019A RLR07C10R0FS		2 000C	2	2	IND		.24E		
0097B	D		RESISTOR	81349	RLR07C1000FS		2 000C	2	2	IND		.24E		
0097C	D		CAPACITOR	56289	513D227M025CD4		3 008C	3	3	IND		.30E		
0097E	D		ASSY, EPROM, PROGRAM	63812	000816-2		1 191C	1	1	IND R L	X	325.00E		
0097F	E		EPROM	81349	SAME AS 0069 M38510/22401BYA		1 191C	1	1	IND		43.07E		
0097G	E		LABEL, STICK ON		SEE 0069A AVY S-816		REF	REF	REF	IND		.50E		
0097H	D		ADHESIVE		M46050, CL 1, TY 1		AR	AR	AR	IND		.10E		

CONTRACT NUMBER: DTFA01-87-C-00006   NOMENCLATURE: MONITOR SYSTEM, LORAN C   MODEL/TYPE NO.: FA-10232

CONTRACTOR: FRONTIER ENGINEERING, INC   DATE OF LIST: MAY 30, 1989   REVISION: B

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	IND	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTORS PART NUMBER	LONG LD CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LL	PP / QTY	SPARES ALLOCATION		
0097I	D		ADHESIVE LABEL	85480	DAT-22-896		1 000C	1	1	IND		.50E		
0097J	C		ANCHOR, CABLE	O6383	ABMM-A		7 000C	7	7	IND		.50E		
0097K	C		SCREWLOCK, PAIR	81349	M24308/26-1		1 000C	1	1	IND		4.00E		
0098	C		EMI FILTER/AC CON	O5245	3EC1		1 000C	1	1	IND		18.46E 112		
0098A	C		CHASSIS, SLIDES, PAIR	O6666	C-300-D-1-20		1 000C	1	1	IND		40.70E		
0098B	C		ASSY, RECEIVER	63812	000740-2		1 000C	1	1	IND	X	6518.50E		
0098C	D		SCREW, CAPTIVE PANEL	61000	SS-10730		2 000C	2	2	IND		.80E		
0099 M	D		RECEIVER, PCB ASSY	4W731	10310526		1 000C	1	1	IND	X	6517.50E 112		
0099A	C		ASSY, SIMULATOR	63812	000740-1		1 000C	1	1	IND	X	2845.00E		

CONTRACT NUMBER: DTFA01-87-C-00006 NOMENCLATURE: MONITOR SYSTEM, LORAN C MODEL/TYPE NO.: FA-10232

CONTRACTOR: FRONTIER ENGINEERING, INC DATE OF LIST: MAY 30, 1989 REVISION: B

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	IND	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTORS PART NUMBER	LONG NO CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LL	PP / QTY	SPARES ALLOCATION		
0099B	D		SCREW, CAPTIVE PANEL	61000	SAME AS 0098C SS 10730		2 000C	2	2	IND		80E		
0100 M	D		SIMULATOR, PCB ASSY	4W731	10310529		1 000C	1	1	IND 1	X	2,844.00E 112		
0101	C		BATTERY, 12V	91558	CF12V1/2L		2 000C	2	2	IND		25.26E 112		
0101A	C		BRACKET, BATTERY	63812	001030-1		2 000C	2	2	IND R 1	X	6.90E		
0102 M	C		POWER CORD	70903	17506		1 000C	1	1	IND		6.16E 112		
0103	C		CABLE ASSY, RCVR	63812	000920-1		1 000C	1	1	IND R L	X	110.00E 112		
0104	D		CONN, 50 POS	81349	M83503/7-10		2 001C	2	2	IND		18.40E 112		
0104A	D		MARKER, DATA B	85480	LAT-42-292		2 000C	2	2	IND		.50E		
0105	C		CABLE ASSY, SIM	63812	000930-1		1 000C	1	1	IND R L	X	110.00E 112		

CONTRACT NUMBER: DTFA01-87-C-00006 NOMENCLATURE: MONITOR SYSTEM, LORAN C MODEL/TYPE NO.: FA-10232

CONTRACTOR: FRONTIER ENGINEERING, INC. DATE OF LIST: MAY 30, 1989 REVISION: B

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	I N D	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTORS PART NUMBER	LONG NO CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LL	 PP / QTY	SPARES ALLOCATION		
0106	D		CONN, 50 POS	81349	SAME AS 0104 M83503/7-10		2 000C	REF	REF	IND		18.40E		
0106A	D		MARKER, DATA B	85480	SAME AS 0104A DAT 42 292		2 000C	REF	REF	IND		.50E		
0107	C		CABLE ASSY, PSCP	63812	000940-1		1 000C	1	1	IND R 1	X	100.00E 112		
0108	D		CONTACTS	O4618	150550-2		12 000C	12	24	IND		2.12E 2688		
0109	D		HOUSING	O4618	1-480704-0		2 001C	2	4	IND		.42E 448		
0109A	D		MARKER, DATAB	85480	SAME AS 0104A DAT 42 292		3 000C	3	3	IND		.50E		
0110	C		CABLE ASSY, FCPU	63812	000960-1		1 000C	1	1	IND R 1	X	95.00E 112		
0111	D		CONN, 10 POS	81349	M83503/7-01		1 002C	1	1	IND		8.00E 112		
0112	D		CONNECTOR	81349	M24308/2-283		1 002C	1	1	IND		6.28E 112		

CONTRACT NUMBER: DTFA01-87-C-00006 NOMENCLATURE: MONITOR SYSTEM, LORAN C MODEL/TYPE NO.: FA-10232

CONTRACTOR: FRONTIER ENGINEERING, INC DATE OF LIST: MAY 30, 1989 REVISION: B

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER SMR CODE	IND	REFERENCE SYMBOL NUMBER NATIONAL STOCK NUMBER	ITEM NAME ITEM AND LOT NO	 FEDERAL MFG CODE	PRIME CONTRACTORS PART NUMBER MANUFACTURERS NUMBER	LONG NO. CODE	QTY PER ASSY RECOM MAINT FACTOR	QTY PER UNIT RECOM OVERHL FACTOR	QTY PER EA USABLE ON CODE	SHELF LIFE OPTIONAL REP / LL	TOTAL RECOM ORDERED PP / QTY	UNIT PRICE SPARES ALLOCATION	EXTENDED UNIT PRICE	REMARKS
0112A	D		CONTACT SIZE 20 DF SKT	OO779	66505-8		4 000C	4	4	IND		0.56E		
0112B	D		MARKER, DATAB	85480	SAME AS 0104A DAT-42-292		2 000C	2	2	IND		.50E		
0113D	D		CONTACT, SOCKET	81349	M39029/57-354		4 001C	4	4	IND		.66E 448		
0114	C		CABLE ASSY, DSP	63812	000970-1		1 000C	1	1	IND R L	X	95.00E 112		
0115	D		CONNECTOR, 14 POS	81349	M83503/7-02		2 004C	3	3	IND		10.05E 336		
0115A	D		MARKER, DATAB	85490	DAT-42-292-1		2 000C	2	2	IND		.50E		
0116	C		CABLE ASSY, PWR	63812	000990-1		1 000C	1	1	IND R L	X	153.00E 112		
0116A	D		RECEPTACLE, INSULATED	O6383	DNF18-206F1B		8 000C	8	8	IND		0.44E		
0116B	D		TIE, CABLE, NYLON	O6383	PLT1M		12 000C	12	12	IND		.30E		

CONTRACT NUMBER: DTFA01-87-C-00006 NOMENCLATURE: MONITOR SYSTEM, LORAN C MODEL/TYPE NO.: FA-10232

CONTRACTOR: FRONTIER ENGINEERING, INC. DATE OF LIST: MAY 30, 1989 REVISION: B

PROVISIO NING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	I N D	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTORS PART NUMBER	LONG NO. CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO.	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LI	PP / QTY	SPARES ALLOCATION		
0117 M	D		HOUSING, 9 POS	O4618	1-480706-0		1 002C	1	1	IND		.47E		
0117A	D		WIRE MARKER, HEAT SHRINK	O6090	23053/5-109-3		30 000C	30	30	IND		0.54E		
0118 Q	D		CONTACTS, SOCKETS	O4618	SAME AS 0108 350550-2		9 000C	REF	REF	IND		2.12E		
0118A	D		DATAB MARKER	85480	SAME AS 0104A DAT-42-292		3 000C	3	3	IND		.50E		
0118B	D		RECEPTACLE, INSULATED	O6383	DNF18-250-F1B		4 000C	4	4	IND		0.44E		
0118C	D		RECEPTACLE, INSULATED	O4618	2-520337-2		3 002C	3	3	IND		0.44E		
0118E	D		RECEPTACLE, INSULATED	O4618	2-520335-2		3 002C	3	3	IND		0.44E		
0118F	D		RING TERMINAL INSLTD	96906	MS25036-149		1 000C	1	1	IND		.50E		
0119D	D		LUG, TERMINAL	O4618	2-520184-2		1 000C	1	1	IND		.23E 112		

CONTRACT NUMBER: DTFA01-87-C-00006 NOMENCLATURE: MONITOR SYSTEM, LORAN C MODEL/TYPE NO. FA-10232
CONTRACTOR: FRONTIER ENGINEERING, INC DATE OF LIST: MAY 0, 1989 REVISION: B PAGE 19 OF 27

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER SMR CODE	I N D	REFERENCE SYMBOL NUMBER NATIONAL STOCK NUMBER	ITEM NAME ITEM AND LOT NO	FEDERAL MFG CODE	PRIME CONTRACTORS PART NUMBER MANUFACTURERS NUMBER	LONG NO. CODE	QTY PER ASSY RECOM MAINT FACTOR	QTY PER UNIT RECOM OVERHL FACTOR	QTY PER EA USABLE ON CODE	SHELF LIFE OPTIONAL REP / LL	TOTAL RECOM ORDERED OPTIONAL PP / QTY	UNIT PRICE SPARES ALLOCATION	EXTENDED UNIT PRICE	REMARKS
0120D	D		LUG, TERMINAL	04618	2-520261-2		1 000C	1	1	IND		.15E 112		
0121D	D		HOUSING, 9 POS		1-480-706-0		1 002C	1	1	IND		.47E 112		
0122	C		CARD ASSY, EXT	63812	000770-1		1 000C	1	1	IND R L	X	165.00E 112		
0123	D		PC BOARD, FAB	63812	000772-1		1 000C	1	1	IND		45.03E 112		
0124	D		CONNECTOR	97137	009-00328-7		1 415C	1	1	IND		4.41E 112		
0125	C		EEPROM MOD ASSY	63812	000790-1		8 000C	8	8	IND R L	X	300.00E 896		
0126	D		PC BOARD, FAB	63812	000792-1		1 000C	1	1	IND		132.29E 896		
0127D	D		EEPROM IC	63812	000815-1		3 415C	3	3	IND		2688		
0128 M	D		EEPROM	60395	X2864ADMB-45		3 415C	3	3	IND		65.98E 2688		

CONTRACT NUMBER: DTFA01-87-C-00006
NOMENCLATURE: MONITOR SYSTEM, LORAN C
MODEL/TYPE NO.: FA-10232
CONTRACTOR: FRONTIER ENGINEERING, INC.
DATE OF LIST: MAY 30, 1989
REVISION: B

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	IND	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTORS PART NUMBER	LONG NO. CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LL	PP / QTY	SPARES ALLOCATION		
0129	D		CAPACITOR	81349	SAME AS 0007 M39014/01-1554		3 000C	REF	REF	IND		1.04E		
0129A	D		EJECTOR, CIRCUIT CARD	22589	EJ-2001-W		2 000C	2	2	IND R 1	X	.30E		
0130	C		PCB ASSY, DRIVER	4W731	10310553		1 010C	1	1	IND		250.00E 112		
0130A	C		PANEL, FRONT	63812	001010-1		1 000C	1	1	IND		60.00E		
0130B	C		PLATE, IDENTIFICATION	63812	001020-1		1 000C	1	1	IND R 1	X	10.00E		
0131	C		FUSE HOLDER	75915	342028		1 000C	1	1	IND		3.03E 112		
0132	C		CABLE ASSY, LED	63812	000980-1		1 000C	1	1	IND R 1	X	175.00E 112		
0133	D		LED, YELLOW	O5464	LL253Y		2 000C	2	2	IND		.71E 2688		
0134	D		LED, RED	O5464	LL203R		1 000C	1	1	IND		.47E 112		

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	I N D	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTORS PART NUMBER	LONG NO. CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LL	OPTIONAL PP / QTY	SPARES ALLOCATION		
0135	D		LED, GREEN	O5464	LL233G		1 000C	1	1	IND		.55E 112		
0136	D		CONN, 14 POS	96906	SAME AS 0115 M83503/7-02		1 000C	REF	REF	IND		10.05E		
0137	D		SWITCH, PCB	96906	MS16712-1		1 022C	1	1	IND		28.58E 112		
0137A	D		TUBING, HEAT SHRINK	15740	FIT-221-1/16		4.12 000C	4.12	4.12	IND		.56/FT		
0137B	D		WIRE MARKER, HEAT SHRINK	85480	HCPS 9-2508W		5 000C	5	5	IND		0.44E		
0137C	D		MARKER, DATAB	85480	SAME AS 0104A DAT-42-292		1 000C	1	1	IND		.50E		
0137E	D		TUBING, HEAT SHRINK	15740	FIT-221-3/16		1.13" 000C	1.13"	1.13"	IND		.50/FT		
0138	D		CLIP, LED MTG	O5464	LL80317		4 000C	4	4	IND		.15E 448		

CONTRACT NUMBER: DTFA01-87-C-00006
NOMENCLATURE: MONITOR SYSTEM, LORAN C
MODEL/TYPE NO.: FA-10232

CONTRACTOR: FRONTIER ENGINEERING, INC.
DATE OF LIST: MAY 30, 1989
REVISION: B

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	IND	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTORS PART NUMBER	LONG NO. CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO.	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LL	PP / QTY	SPARES ALLOCATION		
0139 M	C		SWITCH, ROCKER				1	1	1	IND		30.43E		
				81349	M22885/92-DAA	21BY	022C					112		
0140	C		LCD MOD ASSY				1	1	1	IND		120.00E		
				63812	001040-1		000C			R L	X	112		
0141 M	D		LCD MODULE				1	1	1	IND		72.95E		
				62483	LM23A2C24CBH		000C					112		
0142	D		HEADER, 14 POS				1	1	1	IND		2.92E		
				O4318	87227-7		002C					112		
0143	C		FUSE				1	1	1	IND		.44E		
				75915	312002		251C					112		
0143A	C		BULB				1	1	1	IND		1.80E		
				91929	AMI 91LA85		010C							
0143B	C		ADAPTOR, FASTON TAB				1	1	1	IND		1.00E		
				O4618	61765-2		000C							
0143C	C		CABLE ASSY, CABLE DRVR				1	1	1	IND		108.00E		
				63812	000795-1		000C			R I	X			
0143E	D		CONNECTOR				1	1	1	IND		4.20E		
				81349	M39012/16-0013		001C							

CONTRACT NUMBER: DTFA01-87-C-00006 NOMENCLATURE: MONITOR SYSTEM, LORAN C MODEL/TYPE NO.: FA-10232
CONTRACTOR: FRONTIER ENGINEERING, INC DATE OF LIST: MAY 30, 1989 REVISION: B

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	IND	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTORS PART NUMBER	LONG NO. CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO.	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LL	 PP / QTY	SPARES ALLOCATION		
0143F	D		CONNECTOR	81349	M39012/20-0002		1 000C	1	1	IND		14.50E		
0143G	D		DATAB MARKER	85480	SAME AS 0104A DAT-42-292		4 000C	4	4	IND		.50E		
0143H	C		PC ASSY, EPROM BOARD	63812	000820-1		1 191C	1	1	IND R L	X	240.00E		
0143I	D		PRINTED WIRING BOARD	63812	000822		1 000C	1	1	IND R L	X	30.00E		
0143J	D		EPROM, PROG. ASSY	63812	000816-3		1 191C	1	1	IND R L	X	325.00E		
0143K	E		EPROM, 8KX8		8200503YA		1 191C	1	1	IND		43.07E		
0143L	E		LABEL, STICK ON		SAME AS 0069A AVY S-816		1 000C	1	1	IND		.50E		
0143N	D		CAPACITOR	81349	SAME AS 0007 M39014/01-1554		2 000C	2	2	IND		.50E		
0143O	D		EJECTOR, CIRCUIT CARD	60395	SAME AS 0129A EJ-2001-W		2	2	2	IND R L	X	.30E		

CONTRACT NUMBER: DTFA01-87-C-00006
NOMENCLATURE: MONITOR SYSTEM, LORAN C
MODEL/TYPE NO.: FA-10232

CONTRACTOR: FRONTIER ENGINEERING, INC.
DATE OF LIST: MAY 30, 1989
REVISION: B

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	IND	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTORS PART NUMBER	LONG NO CODE	QTY PER ASSY	QTY PER UNIT	QTY PER SA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL REP / LL	PP / QTY	SPARES ALLOCATION		
0143P	D		EPROM, PROG. ASSY				1	1	1	IND		325 00E		
				63812	000816 4		191C			R L	X			
0143R	E		EPROM, 8KX8		SAME AS 0143K		1	REF	REF	IND		REF		
					8200503YA		191C							
0143S	E		LABEL, STICK ON		SAME AS 0069A		1	1	1	IND		50E		
					AVY S 816		000C							
0143U	D		SOCKET, IC		SAME AS 0094		2	2	2	IND		3 24E		
				81349	828 AG11D		000C							
0143V	D		RESISTOR NETWORK				1	1	1	IND		3 88E		
				81349	M8340109X8200XC									
0144D	B		ANTENNA COUPLER				1	1	1	IND		782 10E		
SEE 0154A				4W731	27010556		020C			R	X	112		
0145D	B		ANTENNA				1	1	1	IND		47 40E		
SEE 0155A				4W731	799110 4208		010C					112		
0145A	C		HANDLE BOW				2	2	2	IND		0 25E		
				1FJ15	10325 A 0832 2		000C							
0146D	B		ANT COUPLER PCB				1	1	1	IND		355 50E		
SEE 0153A				4W731	10310550		020C			L	X	112		

CONTRACT NUMBER DTFA01 87 C 00006 NOMENCLATURE MONITOR SYSTEM LORAN C MODEL/TYPE NO FA 10232

CONTRACTOR FRONTIER ENGINEERING, INC DATE OF LIST OCTOBER 4, 1989 REVISION EB1 PAGE 25 OF 27

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER SMR CODE	IND	REFERENCE SYMBOL NUMBER NATIONAL STOCK NUMBER	ITEM NAME ITEM AND LOT NO.	FEDERAL MFG CODE	PRIME CONTRACTORS PART NUMBER MANUFACTURERS NUMBER	LONG NO. CODE	QTY PER ASSY RECOM MAINT FACTOR	QTY PER UNIT RECOM OVERHL FACTOR	QTY PER EA USABLE ON CODE	SHELF LIFE OPTIONAL REP / LL	TOTAL RECOM ORDERED OPTIONAL PP / QTY	UNIT PRICE SPARES ALLOCATION	EXTENDED UNIT PRICE	REMARKS
0146A	B		KIT, INSTALLATION	63812	000830		1	1	1	IND R L	X	328.54E		
0147A	C		BRACKET, MTG, COUPLER	63812	000780-1		1	1	1	IND R L	X	50.00E		
0148A	C		CONNECTOR	14949	PL75C-213		1 000C	1	1	IND R L		19.50E		
0149A	C		CONNECTOR	14949	PL375C-213		1 000C	1	1	IND R L		16.38E		
0150A	C		CONNECTOR	81349	M39012/30-0010		2 000C	2	2	IND		11.50E		
0151A	C		BRACKET, COUPLER PLATE	63812	000780-2		1 000C	1	1	IND		26.00E		
0151B	C		MOUNTING BRACKET		CB8062-03-0010		1 000C	1	1	IND				REVISION PER APPROVED ECR #0015

CONTRACT NUMBER: DTFA01-87-C-00006 NOMENCLATURE: MONITOR SYSTEM, LORAN C MODEL/TYPE NO.: FA-10232

CONTRACTOR: FRONTIER ENGINEERING, INC. DATE OF LIST: MARCH 14, 1990 REVISION: B2 PAGE 26 OF 27

PROVISIONING PARTS LIST

SYMBOL NO PREFIX OR
UNIT NOMENCLATURE LORAN C MONITOR SYSTEM

ITEM OR SEQUENCE NUMBER	I N D	REFERENCE SYMBOL NUMBER	ITEM NAME		PRIME CONTRACTORS PART NUMBER	LONG NO. CODE	QTY PER ASSY	QTY PER UNIT	QTY PER EA	SHELF LIFE	TOTAL RECOM ORDERED	UNIT PRICE	EXTENDED UNIT PRICE	REMARKS
SMR CODE		NATIONAL STOCK NUMBER	ITEM AND LOT NO.	FEDERAL MFG CODE	MANUFACTURERS NUMBER		RECOM MAINT FACTOR	RECOM OVERHL FACTOR	USABLE ON CODE	OPTIONAL		SPARES ALLOCATION		
										REP / LL	PP / QTY			
0152A	B		ASSY, PCB, COUPLER	4W731	SEE 0146D 10310550		1 020C	1	1	IND		355.50E		
0153A	B		COUPLER, ANTENNA	4W731	27010556		1 010C	1	1	IND L	X	650.00E		
0154A	B		ANTENNA, WHIP, 8'	23657	799110-4208		1 010C	1	1	IND		40.00E		
0155A	B		PC ASSEMBLY, CPU	63812	SAME AS 0044 000720-1		REF 183C	REF	REF	IND		1750.00E		
0156A	B		PC ASSY, POWER SUPPLY	63812	SAME AS 0004M 000750-1		1 002C	1	1	IND R L	X	750.00E 112		
0157A	B		PC ASSY, EXTENDER	63812	SAME AS 0122 000770-1		1 000C	1	1	IND R L	X	165.00E 112		
0158A	B		PC ASSY, EEPROM	63812	SAME AS 0125 000790-1		2 000C	2	2	IND		300.00E		
0159A	B		PC ASSY, EPROM	63812	SAME AS 0143H 000820-1		1 191C	1	1	IND		240.00E		
0160A	B		PC ASSY, SIMULATOR	63812	SAME AS 0099A 000740-1		REF 000C	REF	REF	IND L	X	2845.00E		
0161A	B		PC ASSY, RECEIVER	63812	SAME AS 0098B 000740-2		REF 000C	REF	REF	IND L	X	6518.50E		
0162A	B		PC ASSY, COUPLER	63812	SAME AS 0146D 10310550		1 020C	1	1	IND		355.50E		

CONTRACT NUMBER: DTFA01-87-C-00006 NOMENCLATURE: MONITOR SYSTEM, LORAN C MODEL/TYPE NO. FA 10232

CONTRACTOR: FRONTIER ENGINEERING, INC. DATE OF LIST: OCTOBER 4, 1989 REVISION: B1

SECTION 9 - INSTALLATION/INTEGRATION/CHECKOUT

9.1 INTRODUCTION.- This section presents the installation/integration and checkout procedures for the LORAN-C Monitor. This includes unpacking and handling; installation and checkout; and certifying the equipment as being ready to be placed in service.

9.2 INSTALLATION.- These procedures are to be performed after the equipment rack, antenna, and power cables have been installed by appropriate personnel. Figure 9-1, Interface Control Drawing No. 000701, provides the information necessary for installation.

9.2.1 Unpacking and Handling.- The LORAN-C Monitor is shipped in two boxes. One contains the system unit and the other contains the spare circuit boards and spare components. All packaging is according to MIL-STD-17555.

The system unit is encased in a split form-fit foam cushion. The top half of the cushion is enclosed in a thin antistatic wrap. In the other box, the printed Circuit Boards are packaged in individual antistatic plastic bags. Use the following procedure to unpack the LORAN-C Monitor.

CAUTION

> The LORAN-C Monitor contains metallic oxide semiconductor (MOS) devices. Be sure to follow approved procedures for handling these devices while handling the LORAN-C Monitor. Failure to do so can result in extreme damage to the equipment.

NOTE

> During the following procedure, take care to avoid damaging the shipping container and packing materials. You will save them to reuse in the event of shipping the LORAN-C Monitor.

1. To unpack the system unit, open the top of the box without damaging it. Remove the top half of the foam cushion and its plastic wrap.

2. Lift out the system unit and place the top half of the packing cushion back in the box.

3. Reseal the box and store in a cool, dry place, to be used in the event of reshipping the LORAN-C Monitor.

9.2.2 Inspection Procedures.- Before installing the LORAN-C Monitor in its rack, inspect for evidence of rough handling or breakage. If such evidence is found, follow approved procedures for returning damaged equipment.

9.2.3 Installing the LORAN-C Monitor In Its Rack.

WARNING

The LORAN-C Monitor external power is lethal. Before starting this procedure, make sure that all power is turned OFF to the LORAN-C Monitor power cable.

1. Place the LORAN-C Monitor on its rails and slide partially in. Then gently press the rail latches in and slide the unit farther in until the latches "catch". At this point, it should be possible to connect the antenna and power cables.

CAUTION

In the next step, be careful to make sure that adequate clearance is obtained between the cables, the wall, and the LORAN-C Monitor chassis to avoid crimping or otherwise damaging the cables.

2. Connect the power and antenna connectors.
3. Connect the FCPU to the RS-232 connector on the rear of the LORAN-C Monitor.
4. If a local terminal is being used, connect it to the RS-232 connector on the front of the LORAN-C Monitor.
5. Slide the LORAN-C Monitor the rest of the way into the rack.

9.3 INTEGRATION.- System integration consists of setting the LORAN-C Monitor system configuration. System configuration is set by 8-ement DIP switch A1DS1, located near the front edge of the top of the Monitor Processor Board. Each of the eight switches in A1DS2 is dedicated to a configuration function. Table 9-1 shows the settings for the system configuration switches.

Table 9-1. Configuration Switch Settings

Switch Position	Function
1	Select 32 or 64 kbyte blocks of nonvolatile memory. ON=32 kbyte blocks.
2	Enable/disable Watchdog Timer. ON=Enable.
3	Enable/disable Automatic Alarm Recovery. ON=Enable.
4	Enable/disable IOT Security. ON=Enable.
5	Low-order bit of IOT baud rate (see below).
6	High-order bit of IOT baud rate (see below).
7	Set to ON if the system is connected to an FCPU.
8	Enables automatic certification test on power-up. ON = DISABLE OFF = ENABLE

BAUD RATE SETTINGS:

A1S2-6	A1S2-5	Baud Rate
ON	ON	300
ON	OFF	1200
OFF	ON	2400
OFF	OFF	TBD

9.4 SYSTEM STARTUP AND CHECKOUT.- Use the following procedure to start up and check out the LORAN-C Monitor.

1. Power OFF.
2. Setup the System Configuration DIP Switches (paragraph 9.2).
3. Follow system prompts to enter security password(s), operator ID, and DATE/TIME.
4. From the LORAN-C Monitor Main Directory, select J, PARAMETER SETUP DIRECTORY.
5. From the PARAMETER SETUP DIRECTORY, select Item J12, CLEAR ARCHIVES AND INSTALL DEFAULTS.
6. Follow the prompts to load the system operating parameters for the site.
7. Follow system prompts to load security password(s), operator ID, and DATE/TIME.

8. From the PARAMETER SETUP DIRECTORY, select J2 and install the Monitor ALARM LIMITS for the site.

9. From the PARAMETER SETUP DIRECTORY, select J5 and install the CERT GENERATOR SETUP PARAMETERS for the site.

10. From the PARAMETER SETUP DIRECTORY, select J9 and install the LORAN MON TEST GEN SETUP for the site.

11. Select option L2 from the Main Menu to do a system RESET.

12. Perform the LORAN-C Monitor Test Procedure (paragraph 7.2.2), to certify that the LORAN-C Monitor is operating within specified operating limits.

9.5 Packing for Reshipment.- Use the following procedure to pack the LORAN-C Monitor for shipment.

CAUTION

The LORAN-C Monitor contains metallic oxide semiconductor (MOS) devices. Be sure to follow approved procedures for handling these devices while handling the LORAN-C Monitor. Failure to do so can result in extreme damage to the equipment.

1. Place the LORAN-C Monitor in the shipping container, with the bottom half of the form-fit foam cushion in the bottom.

2. Carefully fit the form-fit top over the LORAN-C Monitor and fold the antistatic wrap into place.

3. Seal the shipping container.

SECTION 10 - COMPUTER SOFTWARE

For information relating to the LORAN-C Monitor software, see detailed design document and top level design document.

SECTION 11 - TROUBLESHOOTING SUPPORT DATA

10310526 PCB ASSY, LORAN RECEIVER (MONITOR)
Rev B 12/29/87

ANI Part No.	Value	QTY	Reference - Designato
00310477-2	PCB	1	
02010501	SHIELD, RF	1	
400011-0004	WASHER, FLAT	5	
400021-0004	WASHER, INT	5	
400031-0004	WASHER, EXT	5	
400071-0004	NUT, #4	1	
400150-0404	SCREW, #4X1/4	5	
400150-0405	SCREW, #4X5/16	1	
510904-0000	BUSHING, INSU.	1	
520002-0003	TEST POINT	3	TP1 TP2 TP3
520025-0020	WASHER, INSUL.	1	
551015-1028	SOCKET (28-PIN)	1	
551100-0110	RF CONNECTOR	1	J1
551303-0150	CONN.	1	J2
552003-0022	FUSE	1	F1
611011-0103	0.01	1	C7
61101-0104	0.1	35	C8 C14 C18 C21 C24 C25 C30 C33 C36 C38 C42 C45 C47 C49 C56 C58 C59 C65 C68 C79 C82 C92 C94 C97 C99 C101 C102 C104 C107 C115C116 C117 C118 C119 C120
611110-0220	22 PF	7	C70 C78 C83 C93 C123 C124 C125
611110-0470	47 PF	1	C60
611110-0471	470 PF	1	C106
611112-0271	270 PF	4	C20 C32 C44 C67
611112-0472	4700 PF	6	C5 C12 C50 C53 C74 C91
611112-0681	680 PF	4	C15 C27 C39C63

ANI Part No.	Value	QTY	Reference - Designator
618002-0106	10 UF, 4V	11	C17 C19 C23 C29 C31 C34 C41 C43 C48 C64 C66
618002-0475	4.7 UF, 10V	40	C6 C9 C10 C11 C13 C16 C22 C26 C28 C35 C37 C40 C46 C51 C52 C61 C62 C69 C71 C73 C75 C76 C77 C80 C81 C88 C95 C96 C98 C100 C103 C105 C109 C110 C111 C112 C113 C114 C121 C122
618003-0475	4.7 UF, 25V	5	C1 C2 C57 C72 C84
618004-0106	10 UF, 25V	8	C3 C4 C54 C55 C86 C87 C89 C90
663001-1000	100 OHM	4	R2 R3 R4 R141
663001-1001	1.0K	3	R104 R124 R167
663001-1002	10.0K	20	R11 R17 R19 R39 R40 R42 R43 R45 R64 R65 R68 R69 R71 R90 R91 R94 R95 R181 R192 R198
663001-1003	100.0K	6	R135 R178 R184 R189 R195 R216
663001-1271	1.27K	12	R28 R30 R32 R55 R56 R58 R80 R82 R84 R118 R119 R121
663001-1401	1.40K	2	R106 R168
663001-1503	150K	2	R112 R129
663001-1541	1.54K	2	R16 R153
663001-1692	16.9K	3	R108 R143 R144
663001-1871	1.87K	4	R7 R9 R12 R158
663001-2150	215 OHM	3	R1 R161 R162
663001-2151	2.15K	31	R20 R23 R24 R26 R27 R48 R49 R50 R52 R53

ANI Part No.	Value	QTY	Reference - Designator
(663001-2151 CONTINUED)			R72 R74 R77 R78 R79
			R109 R113 R114 R115
			R116 R147 R149 R154
			R156 R163 R166 R169
			R176 R182 R187 R193
663001-2152	21.5K	24	R10 R31 R38 R57 R66
			R83 R92 R97 R98
			R102 R103 R107 R120
			R127 R130 R134 R151
			R157 R1165 R170
			R177 R183 R188 R194
663001-3320	332 OHM	2	R145 R217
663001-33R2	33.2 OHM	25	R13 R15 R18 R25 R34
			R44 R51 R60 R70 R75
			R86 R99 R101 R105
			R110 R111 R123 R126
			R128 R131 R138 R140
			R150 R152 R164
663001-3401	3.40K	4	R180 R186 R191 R197
663001-3480	348 OHM	2	R213 R215
663001-3831	3.83 K	4	R132 R142 R199 R200
663001-4020	402 OHM	3	R155 R222 R223
663001-4022	40.2 K	3	R21 R46 R73
663001-4121	4.12 K	1	R14
663001-4640	464 OHM	4	R8 R136 R207 R214
663001-4641	4.64K	12	R22 R36 R37 R41 R47
			R62 R63 R67 R76 R88
			R89 R93
663001-4642	46.4 K	4	R29 R54 R81 R117
663001-49R9	49.9 OHM	6	R5 R208 R209 R210
			R211 R212
663001-5623	562K	1	R201
663001-56R2	56.2 OHM	1	R148
663001-6810	681 OHM	4	R146 R218 R219 R220
663001-6811	6.81K	4	R172 R173 R174 R175
663001-6813	681K	4	R179 R185 R190 R196

ANI Part No.	Value	QTY	Reference - Designator
663001-9311	9.31 K	6	R96 R137 R139 R159 R160 R171
663001-9761	9.76 K	6	R100 R202 R203 R204 R205 R206
669008-0101	100 OHM VAR	4	R35 R61 R87 R125
70327512		1	U29
703MC144110-1		2	U21 U22
703MC334OP-1		1	U8
703MC78M12CT		1	U17
711BAV99		9	UCR1 THRU UCR9
7122N3904		2	Q1 Q16
7122N3906		15	Q2 THRU Q15 Q17
712SMBG60A		1	CR1
71310473		1	U31
713HA19209		1	U33
713HM6264		1	U30
713LM311M		1	U11
713LM324M		7	U18 U19 U23 U24 U25U26 U27
713LM556M		1	U12
713LM837M		4	U2 U3 U4 U9
713MC14051B		1	U7
713MC14053B		3	U6 U14 U16
713MC68B09EFN		1	U28
713NMC9346M		1	U32
713SN74HC00		1	U35
713SN74HC244		1	U34
713UPC4570G2		6	U1 U5 U10 U13 U15 U20
761000-0550		4	L1 L2 L8 L9
76110507	INDUCTOR	1	L3
76110508	INDUCTOR	1	L4
76110509	INDUCTOR	1	L5
76110510	INDUCTOR	1	L6
76110511	INDUCTOR	1	L7

10310550 PCB Assy, Antenna Coupler
Rev B 03/11/88

Item	ANI Part No.	Value	QTY	Reference Designator
1	00310549	PCB	1	
2	520002-0003		6	E1 THRU E6
3	554203-0001		1	K1
4	603000-0121	120 PF	2	C1 C2
5	611011-0103	0.01 UF	1	C9
6	611011-0104	0.1 UF	7	C5 C4 C10 C11 C6 C7 C12
7	618004-0106	10 UF, 25V	2	C8 C3
8	651102-0100	10	2	W1 W2
9	663001-1000	100	1	R18
10	663001-1001	1.00K	2	R12 R14
11	663001-1002	10.0K	2	R7 R15
12	663001-1003	100K	1	R3
13	661102-0106	10M	1	R6
4	663001-1650	165	1	R8
15	663001-1871	1.87K	1	R16
16	663001-2151	2.15K	3	R20 R1 R2
17	663001-2152	21.5K	2	R4 R5
18	663001-4640	464	1	R9
19	663001-4641	4.64K	1	R17
20	663001-49R9	49.9	3	R21 R22 R19
1	663001-56R2	56.2	1	R10
22	663001-6810	681	2	R11 R13
23	711BAV99		2	UCR1 UCR2
24	7122N3904		5	Q1 Q7 Q2 Q5 Q6
25	7122N3906		2	Q4 Q8
26	7122N5484		1	Q3
7	77110068		1	T1
28	761000-0550	55	2	L1 L2

10310529 PCB Assy, 2045 Simulator
Rev B 12/28/87

Item	QTY	Part - Name	Reference - Designator
1	1	00310528	PCB, SIMULATOR
2	1	02010501-1	SHIELD
3	5	400011-0004	WASHER, FLAT
4	5	400021-0004	WASHER, INT
5	5	400031-0004	WASHER, EXT
6	2	400071-0004	NUT, #4
7	5	400150-0404	SCREW, #4X1/4
8	2	400150-0405	SCREW, #4X5/16
9	2	510904-0000	BUSHING, INSU.
10	2	520025-0020	INSULATOR
11	4	520002-0003	TP1 TP4 TP2 TP3
12	1	551015-1028	U3 (SOCKET)
13	1	551100-0111	J1
14	1	551303-0150	J2
15	1	552003-0022	F1
16	2	611011-0103	C13 C54
17	42	611011-0104	C114 C21 C25 C37 C27 C33 C31 C23 C40 C42 C45 C43 C46 C35 C52 C10 C49 C12 C51 C48 C17 C11 C9 C77 C66 C62 C59 C70 C68 C84 C88 C86 C81 C73 C98 C99 C100 C101 C102 C103 C7 C115

Item	QTY	Part - Name	Reference - Designator
18	1	611110-0220	C58
19	2	611110-0470	C5 C105
20	15	611110-0471	C22 C24 C26 C29 C32
			C34 C61 C65 C67 C69
			C71 C78 C79 C90 C104
21	6	611112-0271	C14 C15 C16 C57 C56
			C82
22	1	611112-0472	C19
23	4	611112-0681	C6 C4 C76 C74
24	24	618002-0475	C1 C20 C18 C28 C30
			C44 C47 C53 C50 C64
			C63 C55 C75 C60 C89
			C91 C72 C92 C93 C94
			C95 C96 C97 C8
25	2	618003-0475	C83 C80
26	16	618004-0106	C113 C112 C110 C111
			C85 C87 C2 C3 C36 C38
			C39 C41 C106 C108
		C107 C109	
27	4	659010-0202	R33 R43 R87 R110
28	2	659010-0501	R23 R115
29	1	663001-1000	R119
30	14	663001-1001	R67 R51 R71 R73 R77
			R75 R38 R34 R32 R91
			R102 R83 R146 R147

Item	QTY	Part - Name	Reference - Designator
31	14	663001-1002	R165 R161 R9 R7 R3 R8 R6 R31 R5 R11 R4 R30 R29 R144
32	2	663001-1003	R160 R113
33	3	663001-1271	R88 R89 R81
34	4	663001-1401	R58 R100 R84 R127
35	2	663001-1541	R22 R109
36	1	663001-1650	R47
37	6	663001-1871	R25 R24 R125 R29 R98 R126
38	4	663001-2150	R48 R74 R78 R97
39	14	663001-2151	R69 R39 R120 R141 R85 R112 R151 R54 R118 R117 R116 R80 R86 R93
40	14	663001-2152	R61 R62 R63 R64 R149 R150 R104 R105 R106 R107 R108 R122 R123 R143
41	2	663001-2490	R72 R76
42	6	663001-2491	R37 R41 R40 R42 R35 R36
43	1	663001-2740	R56
44	28	663001-33R2	R157 R158 R16 R17 R15 R18 R19 R20 R46

Item	QTY	Part - Name	Reference - Designator
(44 CONTINUED)			R45 R59 R60 R96 R95
			R128 R133 R134 R135
			R131R130 R129 R124
			R79 R114 R90 R103
			R145 R148
45	1	663001-3320	R53
46	1	663001-3401	R21
47	4	663001-3480	R166 R57 R99 R65
48	5	663001-4020	R2 R50 R55 R94 R152
49	1	663001-4321	R44
50	1	663001-4640	R10
51	7	663001-4641	R26 R28 R82 R154
			R155 R156 R153
52	3	663001-4642	R159 R164 R163
53	10	663001-49R9	R13 R12 R14 R132
			R137 R136 R138 R139
			R68 R140
54	2	663001-5620	R66 R101
55	1	663001-5623	R1
56	3	663001-56R2	R70 R121 R142
57	2	663001-6810	R52 R92
58	1	663001-6811	R162
59	1	663001-9311	R111
60	1	703DAC08HP	U10
61	1	703EL2003CN	U29

Item	QTY	Part - Name	Reference - Designator
62	1	703HA2525	U11
63	2	703LM317L	U17 U19
64	2	703LM337L	U18 U20
65	1	703MC78M12CT	U15
66	1	703MC79M12CT	U16
67	7	711BAV99	UCR1 UCR2 UCR3 UCR4 UCR5 UCR7 UCR6
68	2	7122N3904	Q2 Q5
69	3	7122N3906	Q4 Q1 Q3
70	1	712SMBG60A	CR1
71	1	71310473	U6
72	1	713HM6264	U4
73	1	713LM556M	U1
74	1	713LM837M	U21
75	1	713M2064CNL	U7
76	6	713MC14053B	U14 U12 U26 U22 U25 U27
77	1	713MC68B09EFN	U2
78	2	713SN74HC00	U8 U5
79	5	713UPC4574G2	U9 U13 U23 U24 U28
80	3	761000-0550	L2 L1 L3
81	1	76110511	L4

Chart 5 Transposed to

End of Volume.

APPENDIX A.

ABBREVIATIONS AND ACRONYMS

Term	Meaning
ECD	Envelope Cycle Discrepancy
EEPROM	Electronically Eraseable Programable Read Only Memory
FCPU	Facility Central Processing Unit
GRI	Group Repetition Interval
MCPU	Monitor Central Processing Unit
RAM	Random Access Read/Write Memory
ROM	Read Only Memory
SNR	Signal to Noise Ratio
TD	Time Difference

APPENDIX B.

MEMORY MAP

NOTE: Non-volatile memory block size select switch = ON

/CE0	SCRATCHPAD RAM	000H to 7FFFH
/CE1	NOT USED	8000H to FFFFH
/CE2	RECEIVER/SIMULATOR	1000H to 17FFFH
/CE3	FCPU	18000H to 1FFFFH
/CE4	LOCAL TERMINAL	20000H to 27FFFH
/CE5	DIP SWITCH/FRONT PANEL	28000H to 2FFFFH
/CE6	INTERRUPTCONTROLLER	30000H to 37FFFH
/CE7	DISPLAY	38000H to 3FFFFH
/CE8	NON-VOLATILE MEMORY	40000H to 47FFFH
/CE9	NON-VOLATILE MEMORY	48000H to 4FFFFH
/CE10	NON-VOLATILE MEMORY	50000H to 57FFFH
/CE11	NON-VOLATILE MEMORY	58000H to 5FFFFH
/CE12	NON-VOLATILE MEMORY	60000H to 67FFFH
/CE13	NON-VOLATILE MEMORY	68000H to 6FFFFH
/CE14	EXTENDED PROGRAM MEMORY	70000H to 77FFFH
/CE15	NOT USED	78000H to 7FFFFH

NOTE: 80000H to BFFFFH reserved for Expansion

/CE16	NOT USED	C0000H to C7FFFH
/CE17	NOT USED	C8000H to CFFFFH
/CE18	NOT USED	D0000H to D7FFFH
/CE19	NOT USED	D8000H to DFFFFH
/CE20	NOT USED	E0000H to E7FFFH
/CE21	NOT USED	E8000H to EFFFFH
/CE22	PROGRAM MEMORY	F0000H to F7FFFH
/CE23	PROGRAM MEMORY	F8000H to FFFFFH

NOTE: Non-volatile memory block size select switch - OFF

/CE0	SCRATCHPAD RAM	000H to 7FFFH
/CE1	NOT USED	8000H to FFFFH
/CE2	RECEIVER/SIMULATOR	1000H to 17FFFH
/CE3	FCPU	18000H to 1FFFFH
/CE4	LOCAL TERMINAL	20000H to 27FFFH
/CE5	DIP SWITCH/FRONT PANEL	28000H to 2FFFFH
/CE6	INTERRUPTCONTROLLER	30000H to 37FFFH
/CE7	DISPLAY	38000H to 3FFFFH
/CE8	NON-VOLATILE MEMORY	40000H to 4FFFFH
/CE9	NON-VOLATILE MEMORY	50000H to 5FFFFH
/CE10	NON-VOLATILE MEMORY	60000H to 6FFFFH
/CE11	NON-VOLATILE MEMORY	70000H to 7FFFFH
/CE12	NON-VOLATILE MEMORY	80000H to 8FFFFH
/CE13	NON-VOLATILE MEMORY	90000H to 9FFFFH
/CE14	NON-VOLATILE MEMORY	A0000H to AFFFFH
/CE15	NON-VOLATILE MEMORY	B0000H to BFFFFH
/CE16	NOT USED	C0000H to C7FFFH
/CE17	NOT USED	C8000H to CFFFFH
/CE18	NOT USED	D0000H to D7FFFH
/CE19	NOT USED	D8000H to DFFFFH
/CE20	NOT USED	E0000H to E7FFFH
/CE21	NOT USED	E8000H to EFFFFH
/CE22	PROGRAM MEMORY	F0000H to F7FFFH
/CE23	PROGRAM MEMORY	F8000H to FFFFFH

NOTE: Non-volatile memory block size select switch = ON

/CE8	SUBDIVISIONS:		NON-VOLATILE MEMORY
	P9-15	/CE24	40000H to 41FFFH
	P9-16	/CE25	42000H to 43FFFH
	P9-37	/CE26	44000H to 45FFFH
	P10-15	/CE27	46000H to 47FFFH

/CE9	SUBDIVISIONS:		NON-VOLATILE MEMORY
	P10-16	/CE28	48000H to 49FFFH
	P10-37	/CE29	4A000H to 4BFFFH
	P11-15	/CE30	4C000H to 4DFFFH
		/CE31	4E000H to 4FFFFH

/CE10	SUBDIVISIONS:		NON-VOLATILE MEMORY
	P11-37	/CE32	50000H to 51FFFH
	P12-15	/CE33	52000H to 53FFFH
	P12-16	/CE34	54000H to 55FFFH
	P12-37	/CE35	56000H to 57FFFH

/CE11	SUBDIVISIONS:		NON-VOLATILE MEMORY
	P13-15	/CE36	58000H to 59FFFH
	P13-16	/CE37	5A000H to 5BFFFH
	P13-37	/CE38	5C000H to 5DFFFH
		/CE39	5E000H to 5FFFFH

NOTE: Non-volatile memory block size select switch = ON

/CE12	SUBDIVISIONS:		NON-VOLATILE MEMORY
	P14-16	/CE40	60000H to 61FFFH
	P14-37	/CE41	62000H to 63FFFH
	P15-15	/CE42	64000H to 65FFFH
	P15-16	/CE43	66000H to 67FFFH

/CE13	SUBDIVISIONS:		NON-VOLATILE MEMORY
	P15-37	/CE44	68000H to 69FFFH
	P16-15	/CE45	6A000H to 6BFFFH
	P16-16	/CE46	6C000H to 6DFFFH
	p16-37	/CE47	6E000H to 6FFFFH

/CE14	SUBDIVISIONS:		NON-VOLATILE MEMORY
	P17-15	/CE48	70000H to 71FFFH
	P17-16	/CE49	72000H to 73FFFH
	P17-37	/CE50	74000H to 75FFFH (NOT USED)
	P18-15	/CE51	76000H to 77FFFH (NOT USED)

/CE15	SUBDIVISIONS:		NON-VOLATILE MEMORY
	P18-16	/CE52	78000H to 79FFFH
	P18-37	/CE53	7A000H to 7BFFFH
	P17-38	/CE54	7C000H to 7DFFFH
	P18-38	/CE55	7E000H to 7FFFFH

J	REL TO PROD, REV PER E.O. 0473	1/10/89	KAS
K	REVISED PER E.O. NO. 0509	3/29/89	KAS
L	REVISED PER E.O. NO. 0532	4/?/89	KAS
M	REV PER E.O. NO. 0538	4/24/89	KAS
N	REV PER E.O. 1085	3/13/90	KAS

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
A	REV PER E.O. NO. 0092	3/7/88	KAS
B	REV PER E.O. NO. 0102	3/[illegible]/88	KAS
C	REV PER E.O. NO. 0151	3/25/88	KAS
D	REV PER E.O. NO. 0238	5/20/88	KAS
E	REV PER E.O. NO. 0288	6/21/88	KAS
F	REV PER E.O. NO. 0300	7/11/88	KAS
G	REVISED PER EO NO. 0383	10/21/88	KAS
H	REVISED PER E.O. NO. 0402, 405	11/18/88	KAS

PARTS LIST

QTY	ITEM NO.	FSCM NO.	DRAWING OR PART NO.	NOMENCLATURE OR DESCRIPTION	MANUFACTURER	SPECIFICATION	REF
1	1	----	000760-1	CHASSIS ASS'Y			
1	2	----	000750-1	PC ASSY, POWER SUPPLY			A2
1	3	08779	241-7-20	XFMR, AC POWER	SIGNAL TRANSFORMER		T1
1	4	----	000720-1	PC ASSY, CPU			A1
7	5	06383	ABMM-A	ANCHOR, CABLE	PANDUIT		
1	6	81349	M24308/26-1	SCREWLOCK, PAIR		MIL-C-24308	
3	7	75306	3123	WASHER, NYLON, FLAT	KEYSTONE		
1	8	05245	3EC1	RECEPTACLE, AC	CORCOM		J1
2	9	04618	1-329631-2	NUT, HEX	AMP		
2	10	04618	1-329632-2	WASHER, LOCK	AMP		
1	11	----	000915-1	PANEL, ACCESS			
1	12	----	000900-1	PANEL, TOP			
13	13	72794	AJ4-50-SS	FASTENER, CAPTIVE	DZUS		
1	14	06666	C-300-D-1-20	CHASSIS, SLIDES, PAIR	GENERAL DEVICES		
1	15	----	000740-2	ASSY, RECEIVER	ANI		RE1
1	16	----	000740-1	ASSY, SIMULATOR	ANI		U1
2	17	91558	CF12V 1/2 L	BATTERY, 12V	EAGLE-PICHER		BT1, BT2
2	18	----	001030-1	BRACKET, BATTERY			
1	19	70903	17506	CORD, POWER	BELDEN		
17"	20	06915	SNGS-2.5	GROMMET, STRIP	RICHCO		
8	21	96906	MS51959-43	SCREW, 8-32 X 3/8, FH			
1	22	----	000920-1	CABLE ASS'Y, RECEIVER			W3
1	23	----	000930-1	CABLE ASS'Y, SIMULATOR			W4
1	24	----	000940-1	CABLE ASS'Y, CPU POWER			W2
1	25	----	000960-1	CABLE ASS'Y, FCPU			W5
1	26	----	000970-1	CABLE ASS'Y, LCD			W6
4	27	96906	MS15795-805	WASHER, FLAT, #6			
1	28	----	000990-1	CABLE ASS'Y, AC POWER			W1
4	29	96906	MS35649-264	NUT, HEX, 6-32			
4	30	96906	MS35338-136	WASHER, LOCK, #6			

APPLICATION	
NEXT ASSY	
	000705
END ITEM CODE NO.	

ORIG DATE OF DWG

DRAFTSMAN	CHECKER	GR LEADER

SUBMITTED KAS 2/10/88

APPROVED KAS 2/10/88

APPROVED Paul Chandt 2/11/88

CONTRACT NO. DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

TOP ASSEMBLY, LORAN-C MONITOR

FSCM NO.	SIZE		
63812	B	PL	000700
SCALE		SHEET	1 of 3

best copy available

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
	SEE SHEET 1 OF 3		

PARTS LIST

QTY	ITEM NO.	FSCM NO.	DRAWING OR PART NO.	NOMENCLATURE OR DESCRIPTION	MANUFACTURER	SPECIFICATION	REF
4	31	96906	MS15795-807	WASHER, FLAT, #8			
4	32	96906	MS35338-137	WASHER, LOCK,#8			
4	33	96906	MS35649-284	NUT, HEX, 8-32			
1	34	----	000770-1	PC ASSY, EXTENDER			A4
8	35	----	000790-1	PC ASSY, EEPROM MEMORY			A3
13	36	72794	GP4B	GROMMET, HALF	DZUS		
10	37	96906	MS51957-15	SCREW, 4-40 X 3/8PH			
	38						
AR	39	81349	M22473-C	SEALING COMPOUND, GR-C	(LOCKTITE)		
2	40	04729	P-307-M09-F16-632	STANDOFF, HEX, .469LG., F	UNICORP		
2	41	04729	1312-M09-F16-632	STANDOFF, HEX, .469LG., M	UNICORP		
1	42	4W731	10310553	CABLE DRIVER	ANI		
1	43	----	001010-1	PANEL, FRONT			
1	44	----	001020-1	PLATE, IDENTIFICATION			
8	45	96906	MS35649-244	NUT, HEX, 4-40			
1	46	75915	342028	FUSE HOLDER	LITTLE FUSE		XF1
1	47	----	000980-1	CABLE, LED			W7
4	48	05464	LL80317	CLIP, LED MOUNTING	IEE		
1	49	81349	P/N M22885/92-DAA21BY	SWITCH, ROCKER, ILLUM.		MIL-S-22885	S1
1	50	----	001040-1	ASSY, LCD			DS1
4	51	96906	MS51957-13	SCREW, 4-40 X 1/4 PH			
8	52	96906	MS35333-70	WASHER, INTL TOOTH LOCK#4			
1	53	75915	312002	FUSE, 2A	LITTLE FUSE		F1
10	54	81349	MS15795-803	WASHER, FLAT,#4			
1	55	91929	AML91LA85	BULB	HONEYWELL, MICRO SWITCH		
AR	56	39428	8608K11	RUBBER, FOAM	McMASTER,CARR		
1	57	96906	MS35333-72	WASHER, INTL TOOTH LOCK,#8			
7	60	06383	PLT-1M	TIE, CABLE	PANDUIT		

APPLICATION	
NEXT ASSY	
	000705

ORIG DATE OF DWG

DRAFTSMAN	CHECKER	GR LEADER

SUBMITTED KHS 2/10/88

APPROVED KHS 2/10/88

APPROVED Paul Chevault 2/11/88

CONTRACT NO.
DTFA01-87-C-00006

END ITEM CODE NO.

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

TOP ASSEMBLY,
LORAN-C MONITOR

FSCM NO.	SIZE		
63812	B	PL	000700
SCALE			SHEET 2 of 3

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
	SEE SHEET 1 OF 3		

PARTS LIST

QTY	ITEM NO.	FSCM NO.	DRAWING OR PART NO.	NOMENCLATURE OR DESCRIPTION	MANUFACTURER	SPECIFICATION	REF
1	61	04618	61765-2	ADAPTOR, FASTON TAB	(AMP)		
1	62	----	000795-1	CABLE ASSY, CABLE DRIVER			W8
				DRVR - LORAN-C			
1	63		000820-1	PC ASSY, EPROM BOARD			A6
REF	64		P/N 117AT008	PROC., FINAL PROD. ACCEPT. TEST			
3	65	28520	3683	SUPPORT, NYLON SPACER	HEYCO		
3	66	06915	PS-7-01	SPACER, PUSH, NYLON	RICHCO		
2	67	1FJ15	10325-A-0832-2	HANDLE, BOW			
4	68	96906	MS51959-43	SCREW, 8-32 x 3/8, FH			
4	69	75306	3127	WASHER, FLAT, NYLON	KEYSTONE		

APPLICATION	
NEXT ASSY	
	000705
END ITEM CODE NO.	

ORIG DATE OF DWG
DRAFTSMAN | CHECKER | GR LEADER
SUBMITTED
APPROVED
APPROVED
CONTRACT NO.

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

TOP ASSEMBLY,
LORAN-C MONITOR

FSCM NO. 63812
SIZE B
PL 000700
SCALE
SHEET 3 of 3

NOTES:

1. The assemblies listed in the parts list comprise the complete LORAN-C Monitor System to be provided to the FAA under contract No. DTFA01-87-C-00006. Quantities listed are for one complete shippable assembly, including site spares.

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
—	RELEASE TO PRODUCTION PER EO 0475	2/13/87	

PARTS LIST

QTY	ITEM NO.	FSCM NO.	DRAWING OR PART NO.	NOMENCLATURE OR DESCRIPTION	MANUFACTURER	SPECIFICATION	REF
1	1		000700	ASSY, LORAN-C MONITOR			
1	2		000720	ASSY, PCB, CPU			
1	3		000740-1	ASSY, PCB, SIMULATOR			
1	4		000740-2	ASSY, PCB, RECEIVER			
1	5		000750	ASSY, PCB, POWER SUPPLY			
1	6		000770	ASSY, PCB, EXTENDER			
2	7		000790	ASSY, PCB, EEPROM			
1	8		000820	ASSY, PCB, EPROM			
1	9		000830	KIT, INSTALLATION			
1	10	4W731	10310550	ASSY, PCB, COUPLER	ANI		
1	11	4W731	27010556	COUPLER, ' ANTENNA	ANI		
1	12	23657	799110-4208	ANTENNA, WHIP, 8 ft.	SHAKESPEARE		
REF	13		000701	CONTROL, INTERFACE			

APPLICATION	
NEXT ASSY	FINAL
END ITEM CODE NO.	

ORIG DATE OF DWG 12-28-88

DRAFTSMAN	CHECKER	GR LEADER
WH	KRF 12/88	

SUBMITTED KAS 12/88

APPROVED KAS 2/27/89

APPROVED PDC 3/2/89

CONTRACT NO. DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

ASSY, SHIPPABLE, LORAN-C MONITOR

FSCM NO.	SIZE	
63812	B	000705
SCALE NONE		SHEET 1 OF 1

J	REL TO PROD, REV PER E.O. 0474	1/11/89	KAS
K	REV PER E.O. 0565	5/5/89	KAS
L	REV PER E.O 0602	7/12/89	RL

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
A	REV PER E.O. NO. 0072	2/22/88	KAS
B	REV PER E.O. NO. 0078	2/25/88	KAS
C	REV PER E.O. NO. 0090	3/8/88	KAS
D	REV PER E.O. NO. 0098	3/14/88	KAS
E	REV. PER EO. No. 0150	3/21/88	KAS
F	REV PER EO. NO. 0179	4/11/88	KAS
G	REV PER EO NO. 0279	6/21/88	KAS
H	Rev Per EO No 0335	10/17/88	KAS

PARTS LIST

QTY	ITEM NO.	FSCM NO.	DRAWING OR PART NO.	NOMENCLATURE OR DESCRIPTION	MANUFACTURER	SPECIFICATION	REF
1	1	----	000722 -1	PC BOARD, CPU			
40	2	83149	M39014/01-1554	CAPACITOR, .1uf		MIL-C-39014/1	C1, C18-C40, C42- C57
ALT	2	81349	M39014/01-1553	CAPACITOR, .1uf		MIL-C-39014/1	
6	3	81349	M39014/01-1309	CAPACITOR, 330pf		MIL-C-39014/1	C4-C8, C10
2	4	81349	JANTX1N483B	DIODE		MIL-S-19500/	D1, D2
1	5	83149	M83504/02-028	SWITCH, DIP		MIL-S-83504	S2
2	6	61725	MT2-5V-C93401	RELAY, DIP	ITT SEMICONDUCTOR		K1, K2
ALT	6	61725	RY-5W-K	RELAY, DIP	TAKAMASAWA		
1	7	04618	350431-2	HEADER, 6 POSITION	AMP		J1
1	8	81349	M24308/23-33	CONNECTOR, D, PC MOUNT		MIL-C-24308	J2
2	9	81349	M83503/25-22	HEADER, 50 POSITION		MIL-C-83503	J3, J4
2	10	81349	M83503/25-04	HEADER, 14 POSITION		MIL-C-83503	J5, J6
1	11	81349	M83503/25-01	HEADER, 10 POSITION		MIL-C-83503	J8
9	12	81349	M21097/21-172	CONNECTOR, CONTACT, PWB		MIL-C-21097	J9-J17
1	13	04618	350428-2	HEADER, 2 POSITION	AMP		J19
9	14	97137	009-00473-9	KEY, POLARIZING	TRW		
5	15	81349	JANTX2N2222A	TRANSISTOR		MIL-S-19500	QI-Q5
4	16	81349	RLR07C1002GR	RESISTOR, 10K OHM, ¼W		MIL-R-39017/1	R1,R5,R8,R9
ALT	16	81349	RLR07C1002FS	RESISTOR, 10K OHM, ¼W		MIL-R-39017/1	
ALT	16	81349	RLR07C1002FR	RESISTOR, 10K OHM, ¼W		MIL-R-39017/1	
1	17	81349	RLR07C1003GR	RESISTOR, 100K OHM, ¼W		MIL-R-39017/1	R2
ALT	17	81349	RLR07C1003FS	RESISTOR, 100K OHM, ¼W		MIL-R-39017/1	
ALT	17	81349	RLR07C1003FR	RESISTOR, 100K OHM, ¼W		MIL-R-39017/1	
9	18	81349	RLR07C3010GR	RESISTOR, 301 OHM, ¼W		MIL-R-39017/1	R3,R10-R17
ALT	18	81349	RLR07C3010FS	RESISTOR, 301 OHM, ¼W		MIL-R-39017/1	
ALT	18	81349	RLR07C3010FR	RESISTOR, 301 OHM, ¼W		MIL-R-39017/1	
1	19	81349	RLR07C1502FS	RESISTOR, 15K OHM, ¼W		MIL-R-39017/1	R6
ALT	19	81349	RLR07C1502GR	RESISTOR 15K OHM, ¼W		MIL-R-39017/1	
ALT	19	81349	RLR07C1502FR	RESISTOR 15K OHM, ¼W		MIL-R-39017/1	
2	20	81349	M8340105M1002XC	RESISTOR PACK, 10K OHM, 8 PIN, 1%, ¼W		MIL-R-83401	R19, R20

APPLICATION	
NEXT ASSY	
	000700

END ITEM CODE NO.

ORIG DATE OF DWG 11-02-87

DRAFTSMAN | CHECKER | GR LEADER

SUBMITTED KAS 2/10/88

APPROVED KAS 2/10/88

APPROVED Paul Chevrault 2/11/88

CONTRACT NO.
DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

PC ASSEMBLY, CPU, LORAN-C MONITOR

FSCM NO. 63812 | SIZE B | PL 000720

SCALE | SHEET 1 OF 3

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
	SEE SHEET 1 OF 3		

PARTS LIST

QTY	ITEM NO.	FSCM NO.	DRAWING OR PART NO.	NOMENCLATURE OR DESCRIPTION	MANUFACTURER	SPECIFICATION	REF
	21						
7	22	18310	10-201-2-01	TERMINAL, SOLDER	CONCORD		TP1-TP7
1	23	34649	MD80C88/B	IC, MICROPROCESSOR	HARRIS		U1
3	24	81349	M38510/38201BRA	IC, 8 BIT LATCH		MIL-M-38510	U2,U21,U22
1	25	----	000816-1	ASSY, EPROM, PROGRAMMED			U3,
2	26	34371	HM1-65642C/883	IC, RAM, 8K X 8	HARRIS		U6,U7
ALT	26	66301	EDH8808AC-20LPKMHR	IC, RAM, 8K X 8	EDI		
2	27	81349	M38510/31004BCX	IC, QUAD 2-INPUT AND		MIL-M-38510	U8,U15
1	28	81349	M38510/05602BEX	IC, DIVIDE-BY-N COUNTER		MIL-M-38510	U9
2	29	14933	8500301EX	IC, COUNTER, 14 STAGE	DESC		U10,U11
2	30	81349	M38510/30501BCX	IC, QUAD, 2-INPUT OR		MIL-M-38510	U4,U12
1	31	14933	8406801VA	IC, CLOCK GENERATOR	DESC		U13
2	32	81349	M38510/30003BCX	IC, HEX INVERTER		MIL-M-38510	U14,U33
2	33	14933	8405601CX	IC, DUAL "D" FLIP FLOP	DESC		U16,U19
1	34	14933	8601201CX	IC, COUNTER, 2 STAGE	DESC		U17
2	35	81349	M38510/32403BRX	IC, OCTAL BUFFER		MIL-M-38510	U18,U20
1	36	81349	M38510/32803BRX	IC, BI-DIRECTIONAL BUFFER		MIL-M-38510	U23
1	37	14933	8501601YA	IC, INTERRUPT CONTROLLER	DESC		U24
3	38	81349	M38510/30903BEX	IC, DATA SELECTOR		MIL-M-38510	U25,U30,U41
3	39	81349	M38510/30701BEX	IC, 3-8 DECODER		MIL-M-38510	U26-U28
3	40	14933	8501501XA	IC, SERIAL CONTROLLER	DESC		U31,U32,U34
4	41	81349	M38510/30702BEX	IC, DUAL 1-OF-4 DECODER		MIL-M-38510	U35-U38
1	42	04713	1488/BCXJC	IC, RS-232 TRANSMITTER	MOTOROLA		U39
1	43	04713	1489A/BCXJC	IC, RS-232 RECEIVER	MOTOROLA		U40
1	44	54331	7401B	OSCILLATOR, 16 MHZ	MONITOR		G1
1	45	31649	MP1-15MHZ	CRYSTAL, 15 MHZ	M-TRON		Y1
1	46	31649	MP1-2.4576MHZ	CRYSTAL, 2.4576 MHZ	M-TRON		Y2
1	47	56699	8024EJW103	POTENTIOMETER, 10K	MEPCO/ELECTRA		R21
ALT	47	56699	8024EKW103	POTENTIOMETER, 10K	MEPCO/ELECTRA		

APPLICATION	
NEXT ASSY	
	000700
END ITEM CODE NO.	

ORIG DATE OF DWG

DRAFTSMAN	CHECKER	GR LEADER

SUBMITTED KtS 2/10/88

APPROVED KHS 2/10/88

APPROVED Paul Chenault 2/11/88

CONTRACT NO. DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

PC ASSEMBLY, CPU,
LORAN-C MONITOR

FSCM NO.	SIZE		
63812	B	PL	000720
SCALE			SHEET 2 OF 3

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
	SEE SHEET 1 OF 3	6/17/88	KAS

PARTS LIST

QTY	ITEM NO.	FSCM NO.	DRAWING OR PART NO.	NOMENCLATURE OR DESCRIPTION	MANUFACTURER	SPECIFICATION	REF
18	48	32559	VG1-2	CARD GUIDE	BIVAR		
1	49	91506	840AG11D	SOCKET, IC, 40 POSITION	AUGAT		
2	50	91506	828AG11D	SOCKET, IC, 28 POSITION	AUGAT		
5	51	46384	PFK-632-40	FASTENER	PENN ENGINEERING		
18	52	96906	MS51957-20	SCREW 4-40 X 7/8 PH			
20	53	96906	MS35649-244	NUT, HEX, #4			
18	54	22294	3157	WASHER, NYLON, #4	KEYSTONE		
2	55	96906	MS51957-15	SCREW, 4-40 X 3/8 PH			
20	56	96906	MS35333-70	WASHER, LOCK, #4, INT. TOOTH			
1	57	95146	TPA11-CG-PC-0	SWITCH, PUSHBUTTON, MOM., PC MOUNT	ALCO		S1
4	58	81349	M39014/01-1206	CAPACITOR, 18pf		MIL-C-39014	C2,C3,C12,C1
ALT	58	81349	M39014/01-1286	CAPACITOR, 18pf		MIL-C-39014	
2	59	81349	RLR07C10R0FS	RESISTOR, 10 OHM, ¼W		MIL-C-39017	R24,R25
2	60	81349	RLR07C1000FS	RESISTOR, 100 OHM, ¼W		MIL-R-39017	R22,R23
3	61	56289	513D227M025CD4	CAPACITOR, 220uf	SPRAGUE		C9,C15,C17
40	62	96906	MS15795-803	WASHER, FLAT, #4			
REF	63		000721 -1	SCHEMATIC, CPU			
REF	64		P/N 117AT003	PROCEDURE, TEST, CPU			
AR	65	81348	SN63BS	SOLDER		QQ-S-571	
1	**66**		**000816-2**	**PROM, PROGRAMMED**			**U5**
1.56IN	**67**		**M16878/1BBB000**	WIRE, 30 AWG		**MIL-W-16878/1**	
AR	**68**		**M46050,CL1,TY1**	**ADHESIVE**	**(LOCKTITE SUPER BONDER #420)**		
ALT	33	81349	M38510/30102BCXIC	IC, DUAL "D" FLIP FLOP		MIL-M-38510	U19
1	70	85480	DAT-22-896	ADHESIVE LABEL, WHITE	W. H. BRADY		
ALT	33		5962-8685301CA	IC,54HCT74	DESC		U16, U19

APPLICATION	
NEXT ASSY	
	000700
END ITEM CODE NO.	

ORIG DATE OF DWG

DRAFTSMAN	CHECKER	GR LEADER

SUBMITTED KAS 2/10/88

APPROVED KAS 2/10/88

APPROVED Paul Chenault 2/11/88

CONTRACT NO. DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

PC ASSEMBLY, CPU, LORAN-C MONITOR

FSCM NO.	SIZE		
63812	B	PL	000720
SCALE			SHEET 3 OF 3

J	REL TO PROD, REV PER E.O. 0472	1/10/89	KAS
K	REV PER E.O. 0858	11/9/89	KAS
L	REV PER E.O 1087	3/13/90	KAS

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
A	REV PER E.O. 0080	3/10/88	KAS
B	REV PER E.O. 0107	3/17/88	KAS
C	REV PER E.O. 0165	4/1/88	KAS
D	REV PER E.O. 0252	5/13/88	KAS
E	REV PER E.O. 0259	5/20/88	KAS
F	REV PER E.O. #0276	6/1/88	KAS
G	REV PER E.O. 0278	6/12/88	KAS
H	REV PER E.O. 0290	10/17/88	KAS

PARTS LIST

QTY	ITEM NO.	FSCM NO.	DRAWING OR PART NO.	NOMENCLATURE OR DESCRIPTION	MANUFACTURER	SPECIFICATION	REF
1	1	----	000752-1	POWER SUPPLY PCB			
1	2	56289	601D278G050JT2	CAPACITOR, 2700uf	SPRAGUE		C1
3	3	83149	M39014/01-1554	CAPACITOR, .1uf		MIL-C-39014/1	C2,C3,C5
ALT	3	83149	M39014/01-1553	CAPACITOR, .1uf		MIL-C-39014/1	
	4						
1	5	83149	M39006/22-0580	CAPACITOR, 160uf		MIL-C-39006/22	C6
5	6	83149	JANTX1N5550	DIODE		MIL-S-19500	D1,D4-D7
3	7	83149	JANTX1N3611	DIODE		MIL-S-19500	D2,D8,D11,
1	8	83149	JANTX1N4572	DIODE, ZENER, 6.4V		MIL-S-19500	D3
ALT	8	83149	JANTXV1N4572A	DIODE, ZENER, 6.4V		MIL-S-19500	
1	9	81349	JANTX1N483B	DIODE			D10
1	10	04618	350431-2	HEADER, 6 position	AMP		J1
1	11	04618	350432-2	HEADER, 9 position	AMP		J2
1	12	61725	MT2-24V-C93403	RELAY	ITT SEMICONDUCTOR		K1
ALT	12	61725	RY-24W-K.	RELAY	TAKAMASAW		
	13						
1	14	81349	JANTX2N3868	TRANSISTOR		MIL-S-19500	Q2
	15						
	16						
2	17	81349	RLR07C10R0FS	RESISTOR, 10 ohm		MIL-R-39017/1	R3, R24
2	18	81349	RLR07C1103FR	RESISTOR, 110K ohm		MIL-R-39017/1	R4,R6
1	19	81349	RLR07C1002FR	RESISTOR, 10K ohm		MIL-R-39017/1	R5
1	20	81349	RLR07C4322FS	RESISTOR, 43.2K ohm		MIL-R-39017/1	R7
1	21	81349	RLR07C5111FS	RESISTOR, 5.11K ohm		MIL-R-39017/1	R8
2	22	81349	RLR07C1001FR	RESISTOR, 1K ohm		MIL-R-39017/1	R9,R16
ALT	22	81349	RLR07C1001FS	RESISTOR, 1K ohm		MIL-R-39017/1	
1	23	81349	RLR07C5112FR	RESISTOR, 51.1K ohm		MIL-R-39017/1	R10
1	24	81349	RLR07C1213FS	RESISTOR, 121K ohm		MIL-R-39017/1	R11
1	25	81349	RLR07C1503FR	RESISTOR, 150K ohm		MIL-R-39017/1	R13

APPLICATION	
NEXT ASSY	
	000700
END ITEM CODE NO.	

ORIG DATE OF DWG

DRAFTSMAN	CHECKER	GR LEADER

SUBMITTED KAS 2/10/88

APPROVED KAS 2/10/88

APPROVED Paul Chevalt 2/11/88

CONTRACT NO. DTFA01-87-C-00006

FRONTIER ENGINEERING INC.

STILLWATER, OKLAHOMA 74075

PC ASSY, POWER SUPPLY, LORAN-C MONITOR

FSCM NO.	SIZE			
63812	B	PL	000750	K
SCALE		SHEET 1 OF 3		

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
	SEE SH 1 OF 3		

PARTS LIST

QTY	ITEM NO.	FSCM NO.	DRAWING OR PART NO.	NOMENCLATURE OR DESCRIPTION	MANUFACTURER	SPECIFICATION	REF
1	26	81349	RLR07C2001FR	Resistor, 2K ohm		MIL-R-39017	R14
ALT	26	81349	RLR07C2001FS	Resistor, 2K ohm		MIL-R-39017	
1	27	81349	RLR07C3922FS	Resistor, 39.2K ohm		MIL-R-39017	R15
1	28	81349	RLR07C2742FS	Resistor, 27.4K ohm		MIL-R-39017	R17
ALT	28	81349	RLR07C2742FR	Resistor, 27.4K ohm		MIL-R-39017	
1	29	81349	RLR07C6042FR	Resistor, 60.4K ohm		MIL-R-39017	R19
ALT	29	81349	RLR07C6042GS	Resistor, 60.4K ohm		MIL-R-39017	
1	30	59756	S20K150	Varistor, Metal Oxide	SIEMENS		RV1
11	31	18310	10-201-2-01	TERMINAL, SOLDER	CONCORD		TP1-TP11
1	32	05820	204CB	SINK, HEAT	EG&G WAKEFIELD		
1	33	50507	UC2906J	IC, Battery Charger	UNITRODE		U1
1	34	81349	M38510/11201BCX	IC, Quad Comparator		MIL-M-38510	U2
1	35	72347	PKA2232P	Converter, DC to DC	RIFA		U3
1	36	08779	ST4-48	TRANSFORMER	SIGNAL		T1
2	37	56699	8024EJW103	Potentiometer, 10Kohm	MEPCO/ELECTRA		R18,R25
ALT	37	56699	8024EKW103	Potentiometer, 10Kohm	MEPCO/ELECTRA		
1	38	81349	RLR07C8662FS	Resistor, 86.6K ohm		MIL-R-39017	R21
REF	39	----	000751-1	SCHEMATIC, POWER SUPPLY			
REF	40	----	P/N 117AT003	PROCEDURE, TEST, POWER SUPPLY			
1	41	----	000860-1	BRACKET, POWER SUPPLY			
AR	42	13103	351	THERMAL, COMPOUND, SYNTHETIC BASE	THERMALLOY		
4	43	96906	MS15795-805	Washer, Flat, #6			
4	44	96906	MS35338-136	Washer, Lock, #6			
4	45	96906	MS51957-31	SCREW, 6-32 X 5/8			
1	46	06915	V-1010	CLIP, COMPONENT	RICHCO		
2	47	96906	MS51957-14	SCREW, 4-40X5/16			
1	48	96906	MS15795-803	Washer, Flat, #4			
3	49	22291	3157	Washer, Nylon, #4	KEYSTONE		
3	50	96906	MS35338-135	Washer, Lock, #4			
3	51	96906	MS35649-244	Nut, Hex, #4			

APPLICATION	
NEXT ASSY	
END ITEM CODE NO.	

ORIG DATE OF DWG

DRAFTSMAN	CHECKER	GR LEADER

SUBMITTED KFS 2/10/88

APPROVED KFS 2/10/88

APPROVED Paul Chenault 2/11/88

CONTRACT NO. DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

PC ASSY, POWER SUPPLY, LORAN-C MONITOR

FSCM NO.	SIZE		
63812	B	PL	000750
SCALE		SHEET	2 OF 3

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
	SEE SH 1 OF 3		

PARTS LIST

QTY	ITEM NO.	FSCM NO.	DRAWING OR PART NO.	NOMENCLATURE OR DESCRIPTION	MANUFACTURER	SPECIFICATION	REF
2	52	81349	RLR07C6652FS	Resistor, 66.5K ohm		MIL-R-39017	R20, R22
	53						
ALT	19	81349	RLR07C1002GS	Resistor, 10K ohm		MIL-R-39017	
ALT	25	81349	RLR07C1503FS	Resistor, 150K ohm		MIL-R-39017	
AR	54	81348	SN63BS	SOLDER		QQ-S-571	
1	55	96906	MS51957-23	SCREW, PANHEAD 4-40 X 1 1/2			
1	56	19701	RN60D3321F	Resistor, 3.32K ohm	MEPCO	MIL-R-39017	R27
.5"	57	81349	M16878/1 BBB000	WIRE, 30 AWG		MIL-W-1687841	J3
AR	58	05972	420	Adhesive	Loctite Corp.		
ALT	14	31349	JANTX2N3868S	TRANSISTOR		MIL-S-19500	Q2
1	59	81349	RLR07C1502FS	Resistor, 15K ohm		MIL-R-39017	R28
ALT	21	81349	RLR07C5111FR	Resistor, 5.11K ohm		MIL-R-39017/1	R8

APPLICATION		ORIG DATE OF DWG		
NEXT ASSY		DRAFTSMAN	CHECKER	GR LEADER
		SUBMITTED		
		APPROVED		
END ITEM CODE NO.		APPROVED		
		CONTRACT NO. DTFA01-87-C-00006		

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

PC ASSY, POWER SUPPLY, LORAN-C MONITOR

FSCM NO.	SIZE		
63812	B	PL	000750
SCALE			SHEET 3 of 3

1. The parts listed comprise the items and materials necessary to install each LORAN-C Monitor at the operational sites specified by the FAA.
2. Not Used.
3. Equipment rack mounting hardware is procured as part of the chassis slide assembly, General Devices P/N C-300-D-1-20.

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
	REL TO PROD, REV PER E.O. 0476	2/13/89	KHS
A	REV AS PER E.O. 0524	3/20/89	KHS
B	REV AS PER E.O. 0540	5/4/89	KHS
C	REV PER E.O. 0563	5/5/89	KHS
D	REV PER E.O. 1089	3/13/90	KHS

PARTS LIST

QTY	ITEM NO.	FSCM NO.	DRAWING OR PART NO.	NOMENCLATURE OR DESCRIPTION	MANUFACTURER	SPECIFICATION	REF
1	1		000780-1	BRACKET, MOUNTING, COUPLER			
1	2	05236	CRS-30	RETRACTOR, CABLE	JONATHAN MFG.		
1	3	14949	PL75C-213	CONNECTOR, TWIN-AX, LUGGED	TROMPETOR ELECTRONICS		
1	4	14949	PL375C-213	CONNECTOR, TWIN-AX, THREADED	TROMPETOR ELECTRONICS		
2	5		M39012/30-0010	CONNECTOR, COAX, THREADED RIGHT ANGLE			
1	6	5A218	CB8062-03-0010	Brackets, pair, Chassis slide mounting	General Devices		
1	7			HARDWARD, MOUNTING, EQUIPMENT RACK			3
4	8			SCREW, MACHINE, ¼-20x4"LG, HEX HEAD, FULLY THREADED			
8	9		MS35338-139	WASHER, LOCK, ¼"			
8	10		MS35649-2254	NUT, HEX ¼-20			
2	11			SCREW, #10 x 3/8" Panhead PHILLIPS SELF-TAPPING			
4	12	96906	MS51957-61	SCREW, MACHINE, 10-32x3/8 PANHEAD PHILLIPS			
4	13	96906	MS15795-808	WASHER, FLAT, #10			
1	18		000780-2	BRACKET, COUPLER, PLATE			
4	19			SCREW, MACHINE, HEX HEAD, ¼-20 X 1½" LG			

APPLICATION	
NEXT ASSY	
000705	

END ITEM CODE NO.

ORIG DATE OF DWG 1/6/89

DRAFTSMAN	CHECKER	GR LEADER
WH 12/88	LF 12/88	

SUBMITTED

APPROVED

APPROVED

CONTRACT NO.
DTFA-01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

KIT, INSTALLATION, LORAN-C MONITOR

FSCM NO.	SIZE	
63812	B	PL 000830

SCALE NONE

SHEET 1 of 1

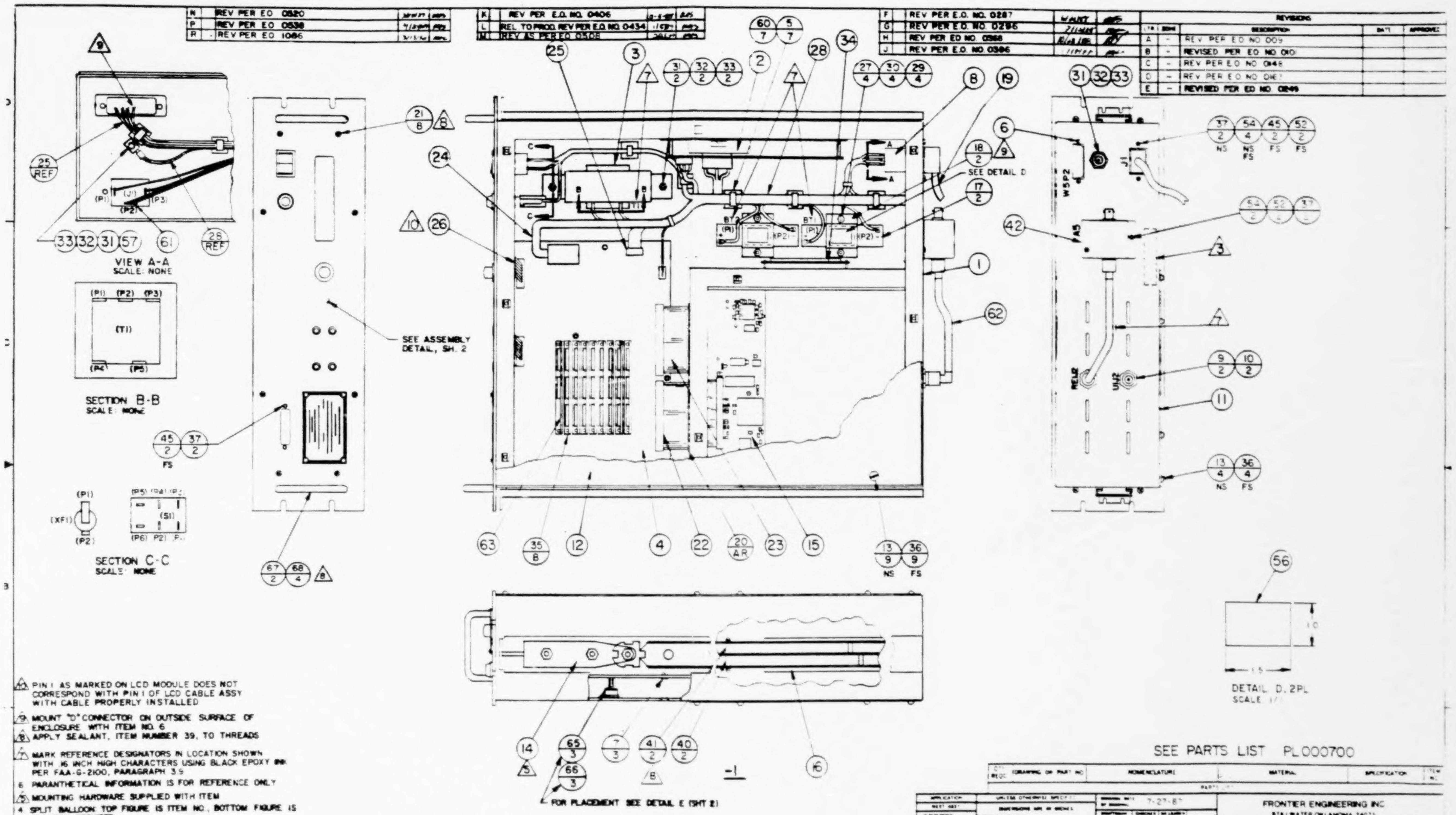
N		REV PER EO 0820	[illegible]	[illegible]
P		REV PER EO 0538	[illegible]	[illegible]
R		REV PER EO 1086	[illegible]	[illegible]

K		REV PER E.O. NO. 0406	12-5-87	[illegible]
L		REL TO PROD. REV PER E.O. NO. 0434	[illegible]	[illegible]
M		REV AS PER EO 0508	[illegible]	[illegible]

F		REV PER E.O. NO. 0287	[illegible]	[illegible]
G		REV PER E.O. NO. 0296	[illegible]	[illegible]
H		REV PER EO NO. 0368	[illegible]	[illegible]
J		REV PER E.O. NO. 0386	[illegible]	[illegible]

REVISIONS

LTR	ZONE	DESCRIPTION	DATE	APPROVED
A	-	REV PER EO NO 009		
B	-	REVISED PER EO NO 0101		
C	-	REV PER E.O NO 0148		
D	-	REV PER E O NO 0167		
E	-	REVISED PER EO NO 0249		



9
25 REF
33 32 31 57 61
26 REF
(P1) (J1) (P3)
(P2)
VIEW A-A
SCALE: NONE
(P1) (P2) (P3)
(T1)
(P4) (P5)
SECTION B-B
SCALE: NONE
45/2 FS 37/2
(P1)
(XF1)
(P2)
(P5) (P4) (P)
(S1)
(P6) P2 (P)
SECTION C-C
SCALE: NONE
21/8 8
SEE ASSEMBLY DETAIL, SH. 2
67/2 68/4 8
10 26
24
25
3
7
31/2 32/2 33/2
2
60/7 5/7
7
28
34
27/4 30/4 29/4
8
19
18/2 9
SEE DETAIL D
17/2
1
62
63 35/8 12 4 22 20/AR 23 15
13/9 NS 36/9 FS
31 32 33
6
W5P2
J1
37/2 NS 54/4 NS FS 45/2 FS 52/2 FS
42
A5
3
7
RELIEF
UN2
9/2 10/2
11
13/4 NS 36/4 FS
56
1.0
1.5
DETAIL D, 2PL
SCALE 1/1
14 5
65/3 66/3
7/3 41/2 40/2
/8
-1
16
FOR PLACEMENT SEE DETAIL E (SHT 2)

10 PIN 1 AS MARKED ON LCD MODULE DOES NOT CORRESPOND WITH PIN 1 OF LCD CABLE ASSY WITH CABLE PROPERLY INSTALLED

9 MOUNT "D" CONNECTOR ON OUTSIDE SURFACE OF ENCLOSURE WITH ITEM NO. 6

8 APPLY SEALANT, ITEM NUMBER 39, TO THREADS

7 MARK REFERENCE DESIGNATORS IN LOCATION SHOWN WITH .16 INCH HIGH CHARACTERS USING BLACK EPOXY INK PER FAA-G-2100, PARAGRAPH 3.9

6 PARANTHETICAL INFORMATION IS FOR REFERENCE ONLY

5 MOUNTING HARDWARE SUPPLIED WITH ITEM

4 SPLIT BALLOON TOP FIGURE IS ITEM NO., BOTTOM FIGURE IS QUANTITY REQUIRED

3 MARK ASSY 63812-000700-1 REV- IN APPROXIMATE LOCATION SHOWN WITH .12 INCH HIGH CHARACTERS USING BLACK EPOXY INK PER FAA-G-2100, PARAGRAPH 3.9

2 WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9

1 INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3

NOTES:

SEE PARTS LIST PL000700

QTY REQD	DRAWING OR PART NO	NOMENCLATURE	MATERIAL	SPECIFICATION	ITEM NO

PARTS LIST

APPLICATION
NEXT ASSY
000705

ORIGINAL DATE OF DRAWING 7-27-87

Kell Leto

CONTRACT NO
DTFA01-87-C-00006

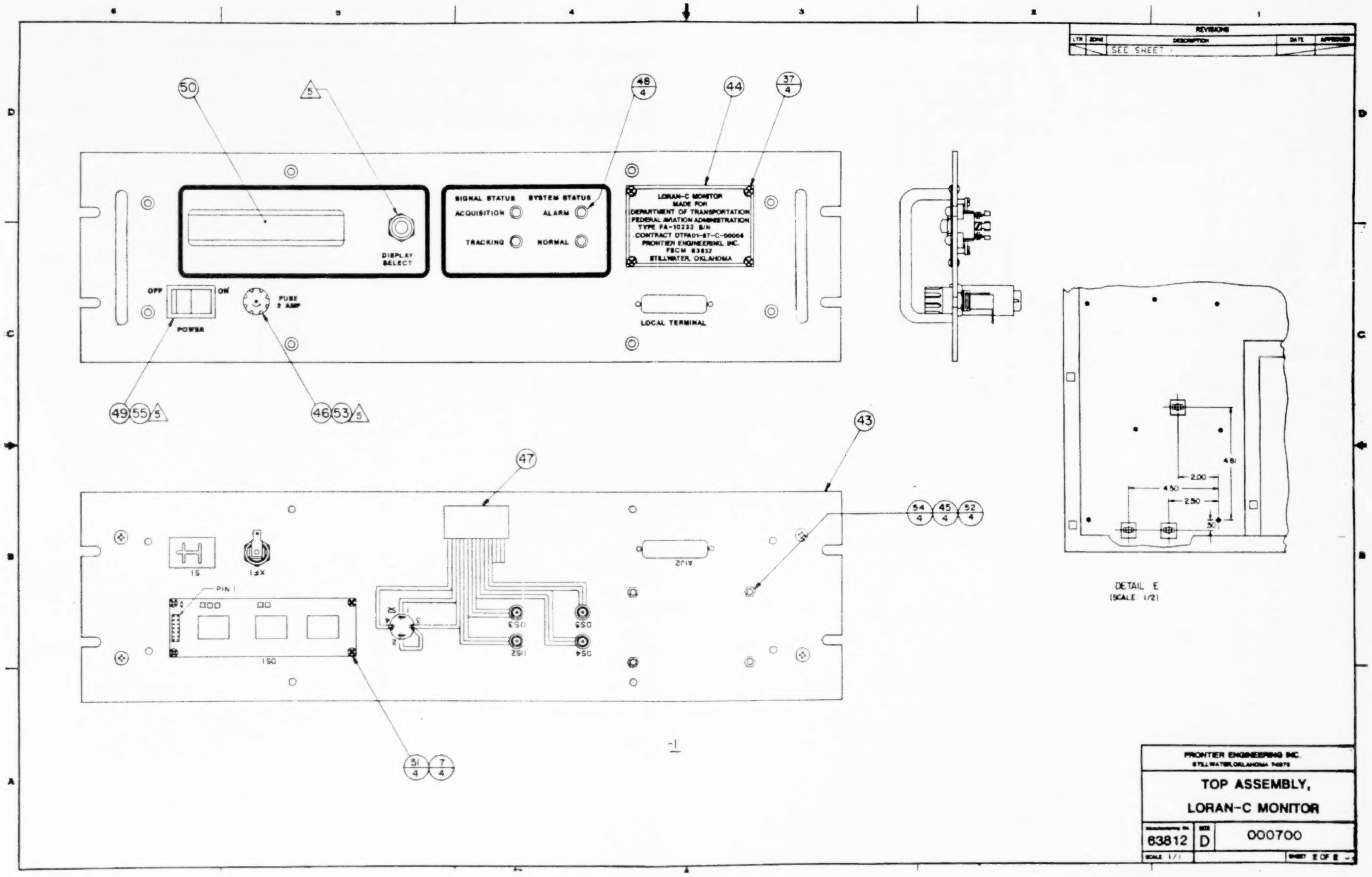
FRONTIER ENGINEERING INC
STILLWATER OKLAHOMA 74075

TOP ASSEMBLY,
LORAN-C MONITOR

63812 D 000700

SCALE 1/2

SHEET 1 OF 2


REVISIONS
LTR
ZONE
DESCRIPTION
DATE
APPROVED
SEE SHEET 1
50
5
48
4
44
37
4
DISPLAY SELECT
SIGNAL STATUS
SYSTEM STATUS
ACQUISITION
ALARM
TRACKING
NORMAL
LORAN-C MONITOR
MADE FOR
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
TYPE FA-10232 S/N
CONTRACT DTFA01-87-C-00006
FRONTIER ENGINEERING, INC.
FSCM 63812
STILLWATER, OKLAHOMA
OFF
ON
POWER
FUSE
2 AMP
LOCAL TERMINAL
49 55 5
46 53 5
43
47
54
4
45
4
52
4
S1
XF1
PIN 1
DS1
A1J2
S2
DS2
DS3
DS4
DS5
51
4
7
4
4.81
2.00
4.50
2.50
.50
DETAIL E
(SCALE 1/2)
-1

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

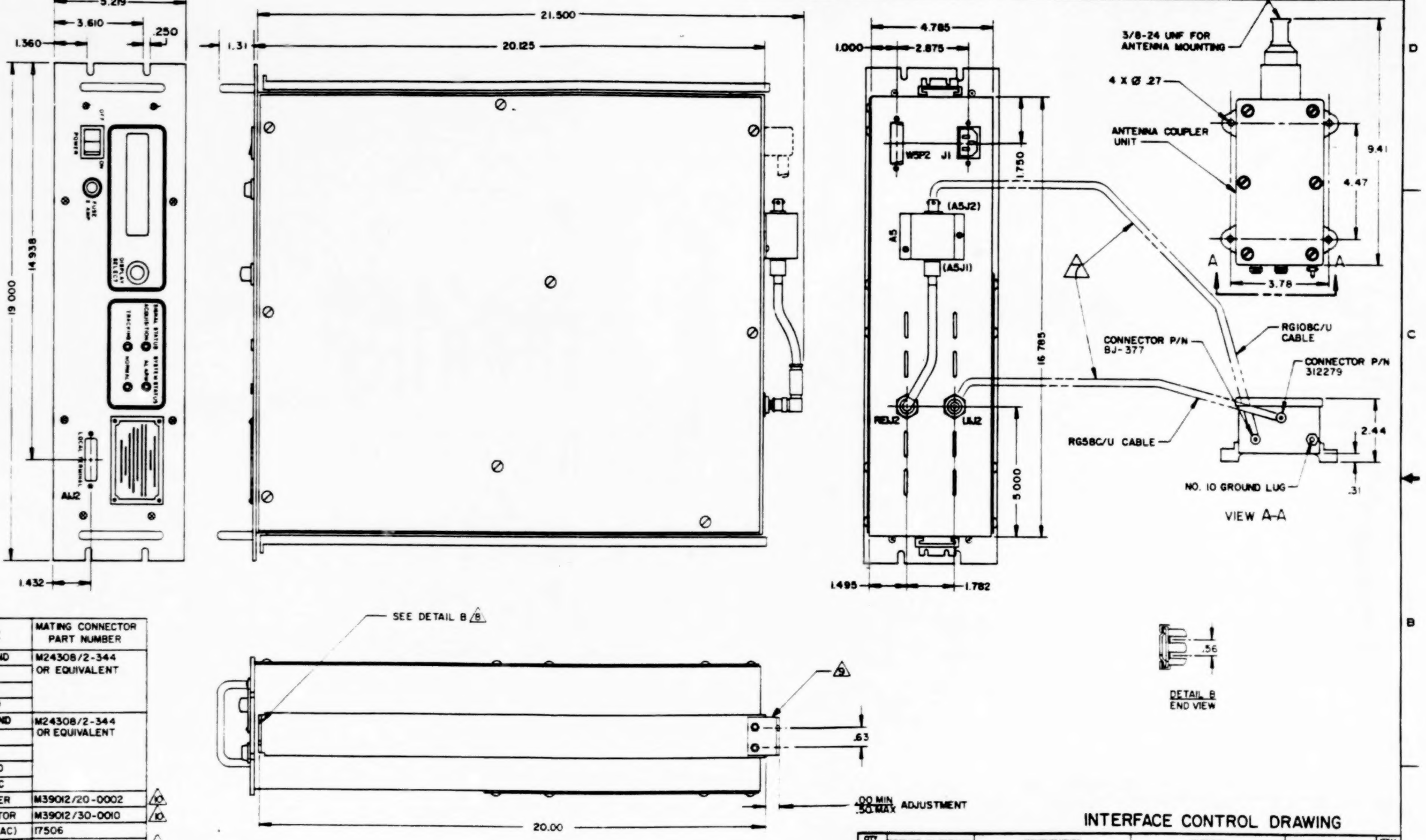
TOP ASSEMBLY,
LORAN-C MONITOR

63812	D	000700
SCALE 1/1		SHEET 2 OF 2 -1

LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REV PER E.O. NO 0166	[illegible]	[illegible]
B		REV PER E.O. NO 0285	[illegible]	[illegible]
C		REV PER E.O. NO 0297	[illegible]	[illegible]
D		REV PER E.O. NO. 0369	[illegible]	[illegible]
E		REV PER EO NO 0407	[illegible]	[illegible]
F		REL. TO PROD REV PER EO NO 0436	[illegible]	[illegible]
G		REV PER EO 0507	[illegible]	[illegible]
H		REV PER EO 0542	[illegible]	[illegible]

NOTES:

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. THIS DRAWING SHALL NOT BE USED FOR FABRICATION OR INSPECTION
3. POWER REQUIREMENTS: 120VAC 60HZ
4. ESTIMATED WEIGHT: 15 LBS
5. HEAT DISSIPATION: 40 WATTS
6. OPERATING TEMPERATURE RANGE: -10°C TO 50°C
7. LENGTHS OF RG108C/U CABLE AND RG58C/U CABLE TO BE DETERMINED DURING FINAL ASSEMBLY IN THE FIELD
8. MOUNTING HARDWARE SUPPLIED WITH ITEM
9. ACTUAL MOUNTING BRACKET MAY VARY IN LENGTH DEPENDING ON DEPTH OF EQUIPMENT RACK USED
10. CRIMP TOOLS FOR INSTALLATION ARE:
    - M22520/5-01 TOOL
    - M22520/5-11 DIE
11. CRIMP TOOLS FOR INSTALLATION ARE:
    - CENTER PIN:
        - M22520/1-01 TOOL
        - 0100-0044 POSITIONER
    - SHIELD:
        - M22520/1-01 TOOL
        - CD5-8 DIE


5.219
3.610
1.360
.250
1.31
21.500
20.125
19.000
14.938
1.432
OFF
POWER
ON
FUSE 2 AMP
DISPLAY SELECT
SIGNAL STATUS
ACQUISITION
TRACKING
SYSTEM STATUS
ALARM
NORMAL
LOCAL TERMINAL
A1J2
4.785
1.000
2.875
W5P2
J1
1.750
(A5J2)
A5
(A5J1)
16.785
RE1J2
U1J2
5.000
1.495
1.782
3/8-24 UNF FOR ANTENNA MOUNTING
4 X Ø .27
ANTENNA COUPLER UNIT
9.41
4.47
A
A
3.78
7
CONNECTOR P/N BJ-377
RG108C/U CABLE
CONNECTOR P/N 312279
RG58C/U CABLE
2.44
NO. 10 GROUND LUG
.31
VIEW A-A
SEE DETAIL B 8
9
.63
.00 MIN .50 MAX ADJUSTMENT
20.00
.56
DETAIL B
END VIEW

CONNECTOR REF. DESIGNATOR	CONNECTOR PART NUMBER	PIN NO.	SIGNAL NAME	MATING CONNECTOR PART NUMBER	
A1J2	M24308/23-33	1	PROTECT GROUND	M24308/2-344 OR EQUIVALENT	
		2	TD (IOT)		
		3	RD (IOT)		
		7	SIGNAL GROUND		
W5P2	M24308/2-283	1	PROTECT GROUND	M24308/2-344 OR EQUIVALENT	
		2	TD (FCPU)		
		3	RD (FCPU)		
		7	SIGNAL GROUND		
			ALL OTHERS NC		
RE1J2			LORAN RECEIVER	M39012/20-0002	10
U1J2			LORAN SIMULATOR	M39012/30-0010	10
J1	3EC1		INPUT POWER (AC)	17506	
A5J2	BJ-77		DIFFERENTIAL COUPLER OUTPUT	PL75C-213	11
A5J1			LORAN RECEIVER	M39012/16-0013	10
ACU TWIN-AX	BJ-377		DIFFERENTIAL COUPLER OUTPUT	PL375C-213	11
ACU CO-AX	312279		LORAN SIMULATOR	M39012/30-0010	10

INTERFACE CONTROL DRAWING

QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MATERIAL	SPECIFICATION	ITEM NO

PARTS LIST

APPLICATION
NEXT ASSY

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:

MATERIAL

END ITEM CODE NO.

ORIGINAL DATE OF DRAWING 12-10-87
DRAFTSMAN RCD
CHECKED
APPROVED
CONTRACT NO. DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

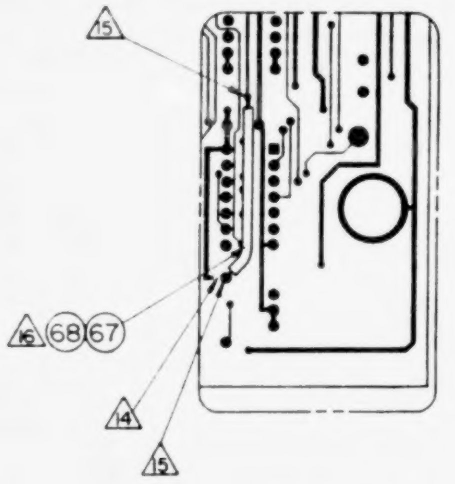
INTERFACE CONTROL DRAWING,
LORAN-C MONITOR

63812
SIZE D
000701
SCALE 1:2
SHEET 1 OF 1

NOTES:

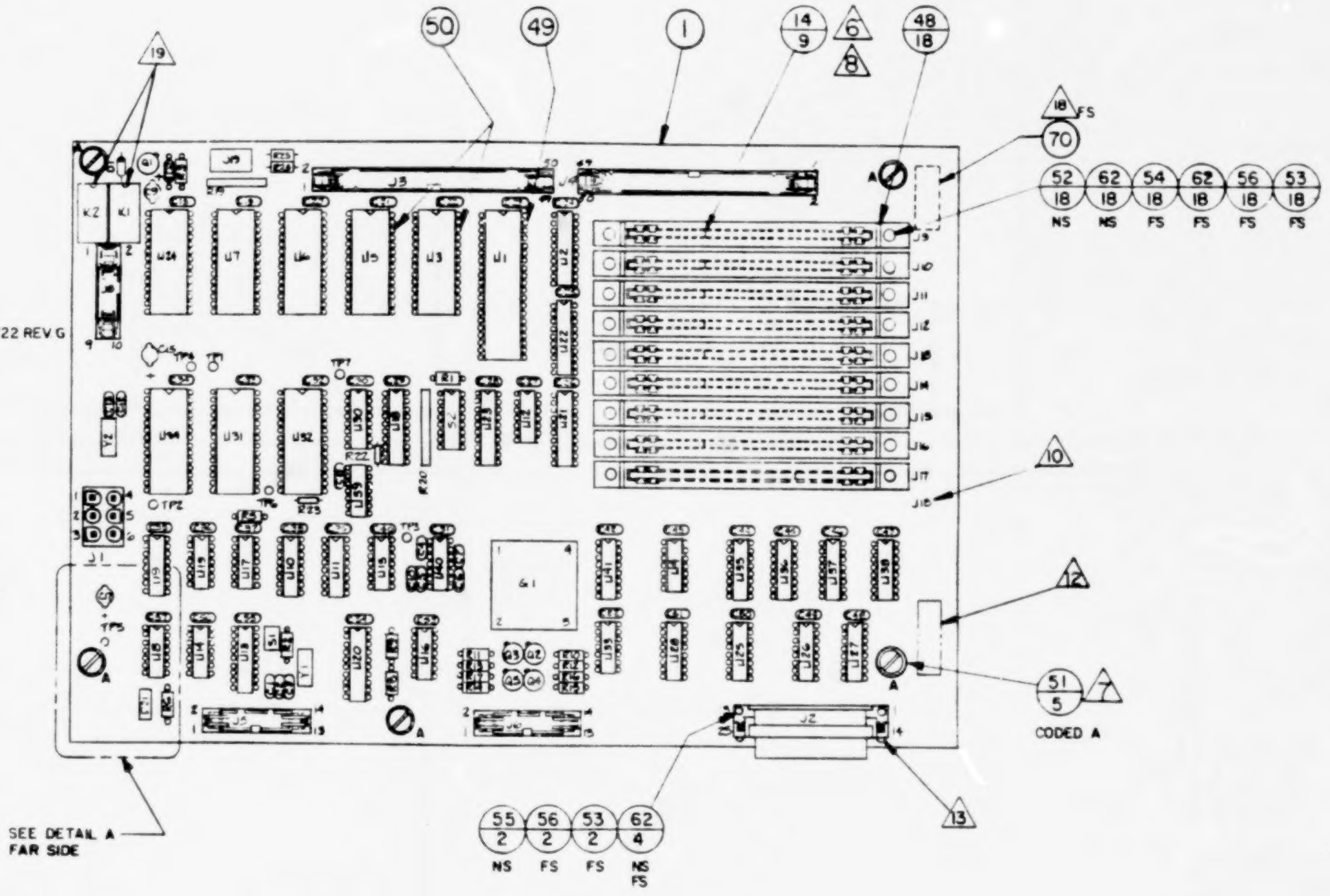
1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
3. REFERENCE DESIGNATORS NOT USED ARE: C6, C11, U29, J7, R4, R7, R18, C14, C41
4. HIGHEST REFERENCE DESIGNATORS USED ARE: S2, C57, R25, Q5, J19, K2, D2, TP7, Y2, G1 AND U41
5. PREFIX ALL REFERENCE DESIGNATORS WITH A1
6. INSTALL ITEM NO.14 BETWEEN PINS 7 AND 8 OF J9 THRU J16
7. INSTALL ITEM NO.51 BEFORE PROCEEDING WITH SOLDERABLE COMPONENTS
8. INSTALL ITEM 14 BETWEEN PINS 15 AND 16 OF J17
9. SOLDER PER MIL-STD-454, REQUIREMENT 5, USING ITEM 65
10. LOCATION J18 FOR FUTURE EXPANSION, DO NOT INSTALL CONNECTORS IN THIS LOCATION, MASK J18 PLATED THRU HOLES
11. SPLIT BALLOON: TOP FIGURE IS ITEM NO., BOTTOM FIGURE IS QUANTITY REQUIRED
12. ENGRAVE SERIAL NUMBER IN LOCATION SHOWN
13. REMOVE SELF-TAPPING SCREWS
14. CUT SOLDER RUN IN LOCATION SHOWN
15. SOLDER INSULATED JUMPER, ITEM 67, INTO FEED-THROUGH AND TO PAD FOR RESISTOR, ITEM 19
16. ROUTE JUMPER AS SHOWN, THEN SECURE WITH ADHESIVE, ITEM 68
17. SERIAL NUMBERS 0001 THRU 0150, WITH MODIFICATION SHOWN IN DETAIL A, ARE EQUIVALENT TO REV. E ARTWORK AND REV. B SCHEMATIC (SERIAL NUMBERS 0151 AND GREATER)
18. COVER AREA SHOWN WITH WHITE ADHESIVE LABEL, ITEM NO 70, AND MARK PART NO 63812-000722 REV G WITH .09 HIGH CHARACTERS USING BLACK EPOXY INK PER FAA-G-2100, PARAGRAPH 3.9, SERIAL NUMBERS 0001 THRU 0150 ONLY
19. DESIGNATES PIN 1 SIDE OF RELAY. SYMBOLS DO NOT RESEMBLE PHYSICAL CHARACTERISTICS OF SOME RELAYS

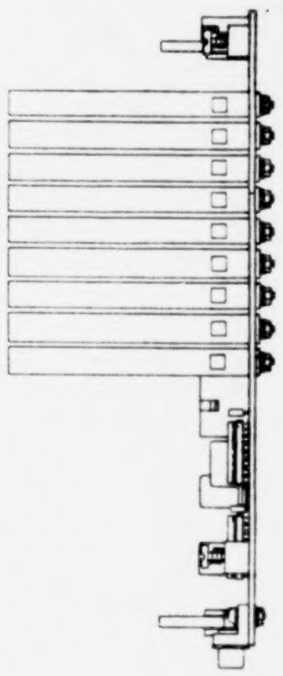
REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REV PER E.O. NO. 0071	[illegible]	[illegible]
B		REV PER E.O. NO. 0079	[illegible]	[illegible]
C		REV PER E.O. NO. 0095	[illegible]	[illegible]
D		REV PER E.O. NO. 0162	[illegible]	[illegible]
E		REV PER E.O. NO. 0178	[illegible]	[illegible]
F		REV PER E.O. NO. 0280	6/17/84	[illegible]
G		REV PER E.O. NO. 0333	[illegible]	[illegible]
H		REL TO PROD, REV PER E.O. NO. 0437	[illegible]	[illegible]
J		REV PER EO 0506	[illegible]	[illegible]
K		REV PER EO 0603	[illegible]	[illegible]



DETAIL A
14 15 16 17

SERIAL NUMBERS 0001 THRU 0150 ONLY OR ARTWORK 000722 REV E AND EARLIER





SEE PARTS LIST PL000720

QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MATERIAL	SPECIFICATION	ITEM NO.

PARTS LIST

APPLICATION
NEXT ASSY
000700

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PLACE DECIMALS ± .01
3 PLACE DECIMALS ± .005
FRACTIONS ± 1/32
ANGLES ± 0°30'

MATERIAL

ORIGINAL DATE OF DRAWING 11-02-87

CONTRACT NO. DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

PC ASSEMBLY, CPU,
LORAN-C MONITOR

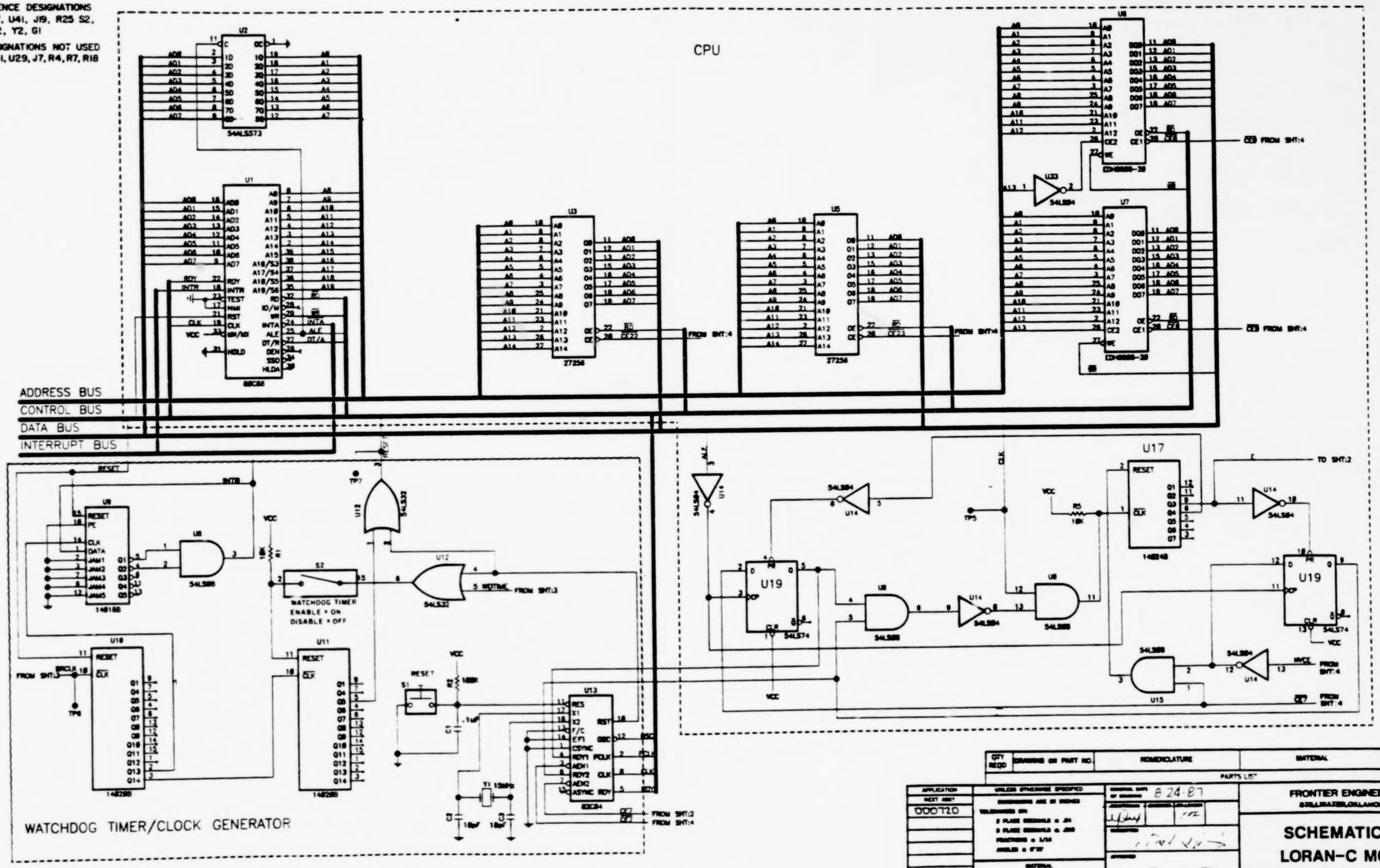
63812 D 000720

SHEET 1 OF 1

NOTES:

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. ALL RESISTANCE IN OHMS
3. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ALL DESIGNATORS WITH: A1
4. HIGHEST REFERENCE DESIGNATIONS USED ARE: C57, U41, J19, R25 S2, TP7, Q5, D2, K2, Y2, G1
5. REFERENCE DESIGNATIONS NOT USED ARE: C11, C16, C41, U29, J7, R4, R7, R18

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REVISED 11-17-87	11/17/87	[illegible]
B		REV PER E.O. NO. 0097	7/20/88	[illegible]
C		REV PER EO NO. 0203	7/6/88	[illegible]
D		REV AS PER E.O. 0394	11/7/88	[illegible]
E		RELEASE TO PRODUCTION, REV PER EO 0433	1/5/89	[illegible]


CPU
U1
88C88
U2
54LS573
U3
27256
U5
27256
U6
CDM6264-30
U7
CDM6264-30
U33
54LS04
A13
CE3 FROM SHT:4
CE4 FROM SHT:4
FROM SHT:4
ADDRESS BUS
CONTROL BUS
DATA BUS
INTERRUPT BUS
RESET
INTR
U9
14016B
U8
54LS08
U12
54LS32
TP7
VCC
S2
WATCHDOG TIMER
ENABLE = ON
DISABLE = OFF
WDTIME
FROM SHT:3
U10
14020B
U11
14020B
FROM SHT:1
TP6
RESET
S1
U13
82C84
Y1 15MHz
18pF
18pF
.1uF
FROM SHT:2
FROM SHT:4
WATCHDOG TIMER/CLOCK GENERATOR
ALE
U14
54LS04
CLK
TP5
R5
10K
U17
14024B
TO SHT:2
U19
54LS74
U8
54LS08
U15
54LS08
VCC
FROM SHT:4

QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MATERIAL	SPECIFICATION	ITEM NO

PARTS LIST

APPLICATION

NEXT ASSY

000720

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES

TOLERANCES ON:

2 PLACE DECIMALS ± .01

3 PLACE DECIMALS ± .005

FRACTIONS ± 1/16

ANGLES ± 0°30'

MATERIAL

ORIGINAL DATE OF DRAWING 8 24 87

APPROVED 12/29/87

CONTRACT NO.

DTFA01-87-C-00006

FRONTIER ENGINEERING INC.

STILLWATER, OKLAHOMA 74075

SCHEMATIC, CPU, LORAN-C MONITOR

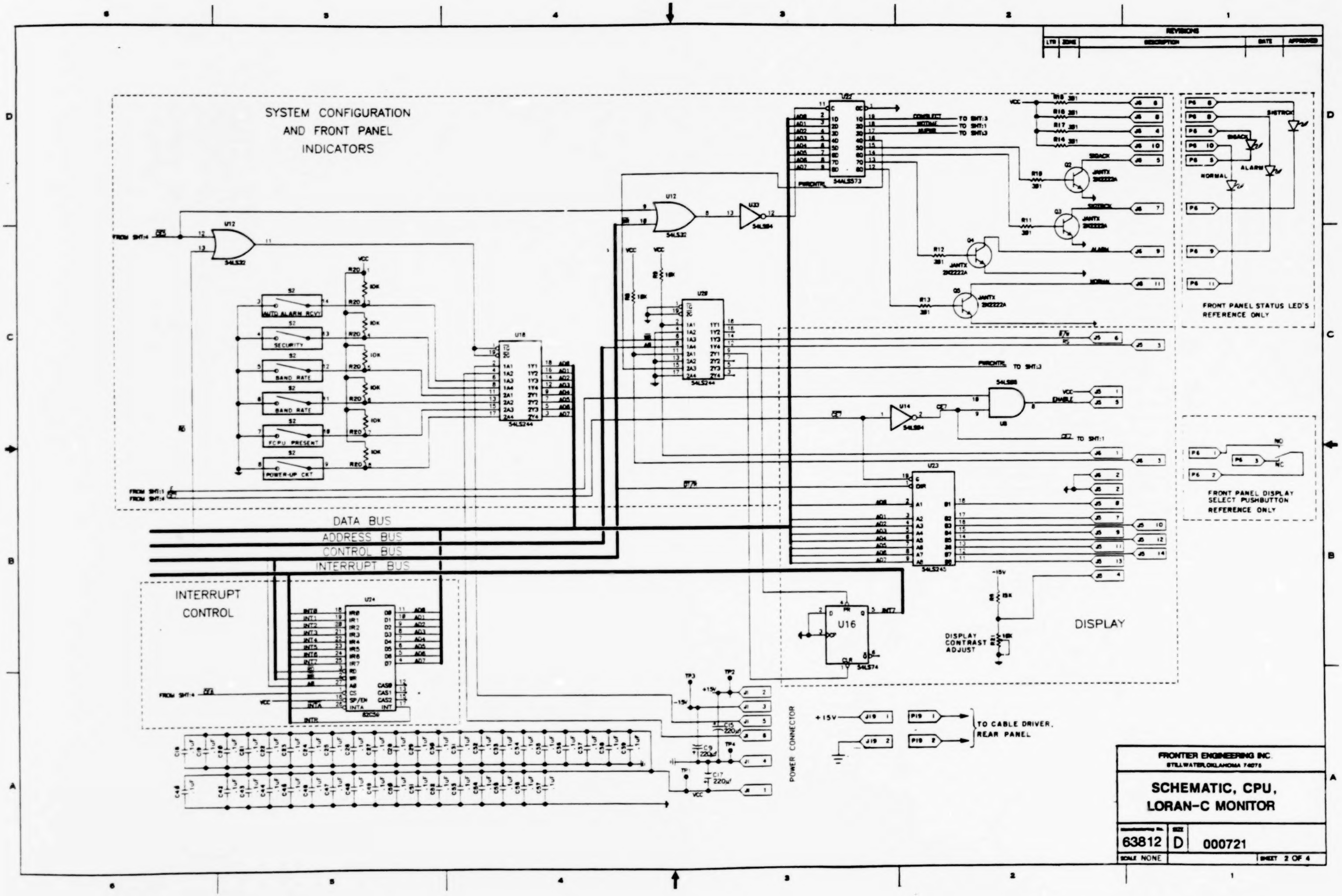
Manufacturing No. 63812

SIZE D

000721

SCALE NONE

SHEET 1 OF 4


REVISIONS
LTR
ZONE
DESCRIPTION
DATE
APPROVED
SYSTEM CONFIGURATION AND FRONT PANEL INDICATORS
FROM SHT:4
U12
54LS32
S2
AUTO ALARM RCVY
SECURITY
BAUD RATE
BAUD RATE
FCPU PRESENT
POWER-UP CKT
VCC
R20
10K
U18
54LS244
U29
54LS244
U33
54LS04
U22
54ALS573
PWRCNTRL
TO SHT:3
TO SHT:1
R15 391
R16 391
R17 391
R14 391
R10 391
R11 391
R12 391
R13 391
Q2
Q3
Q4
Q5
JANTX 2N2222A
SIGACK
SIGTRCK
ALARM
NORMAL
J6
P6
FRONT PANEL STATUS LED'S REFERENCE ONLY
J5
54LS08
ENABLE
U8
U14
54LS04
U23
54LS245
FRONT PANEL DISPLAY SELECT PUSHBUTTON REFERENCE ONLY
NO
NC
DATA BUS
ADDRESS BUS
CONTROL BUS
INTERRUPT BUS
INTERRUPT CONTROL
U24
82C59
INTR
U16
54LS74
INT7
-15V
15K
DISPLAY CONTRAST ADJUST
DISPLAY
TP1
TP2
TP3
TP4
+15V
C15 220µf
C9 220µf
C17 220µf
J1
POWER CONNECTOR
J19
P19
TO CABLE DRIVER, REAR PANEL
.1µf
A
B
C
D
1
2
3
4
5
6

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

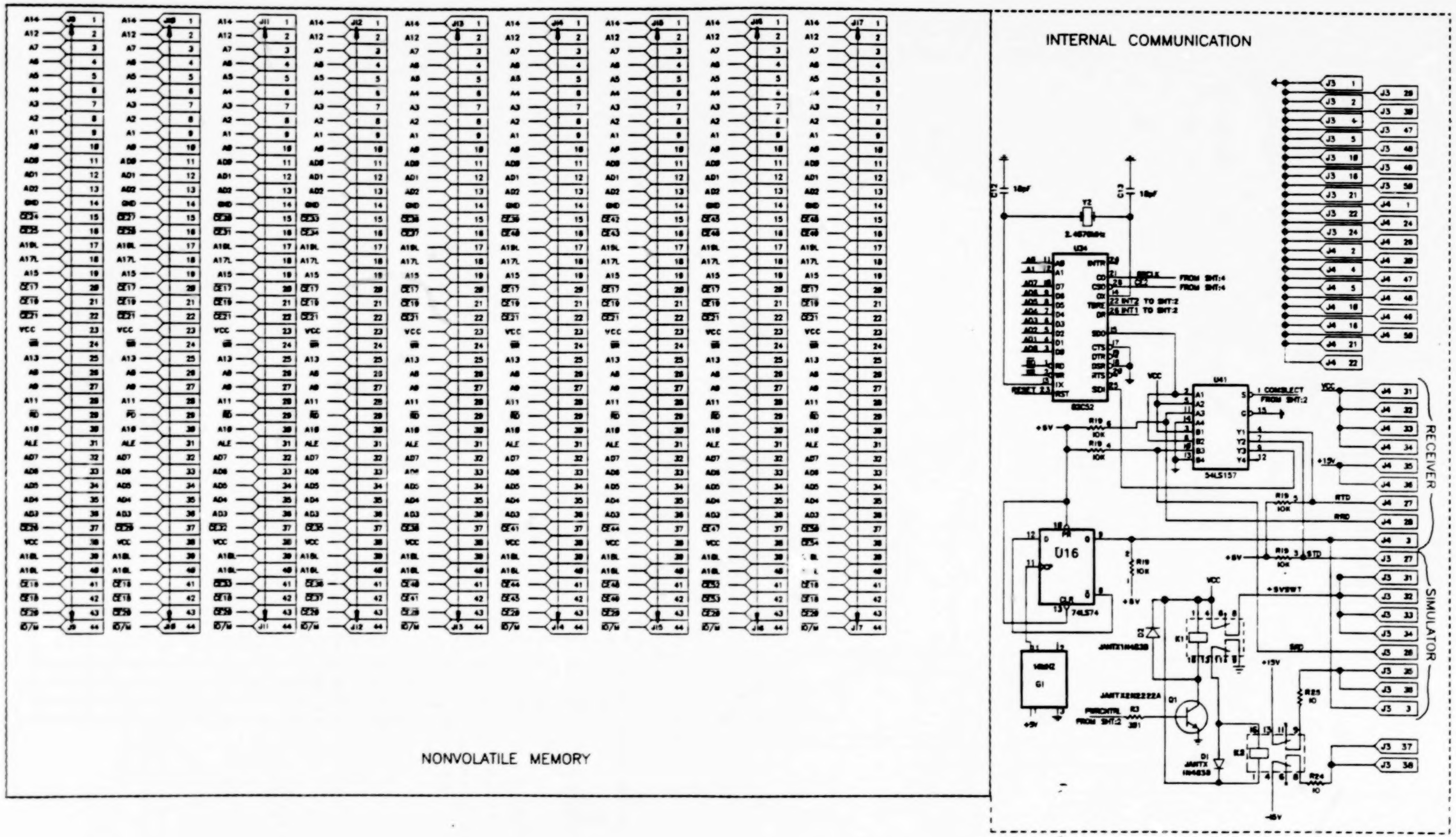
SCHEMATIC, CPU,
LORAN-C MONITOR

63812 | D | 000721

SCALE NONE

SHEET 2 OF 4

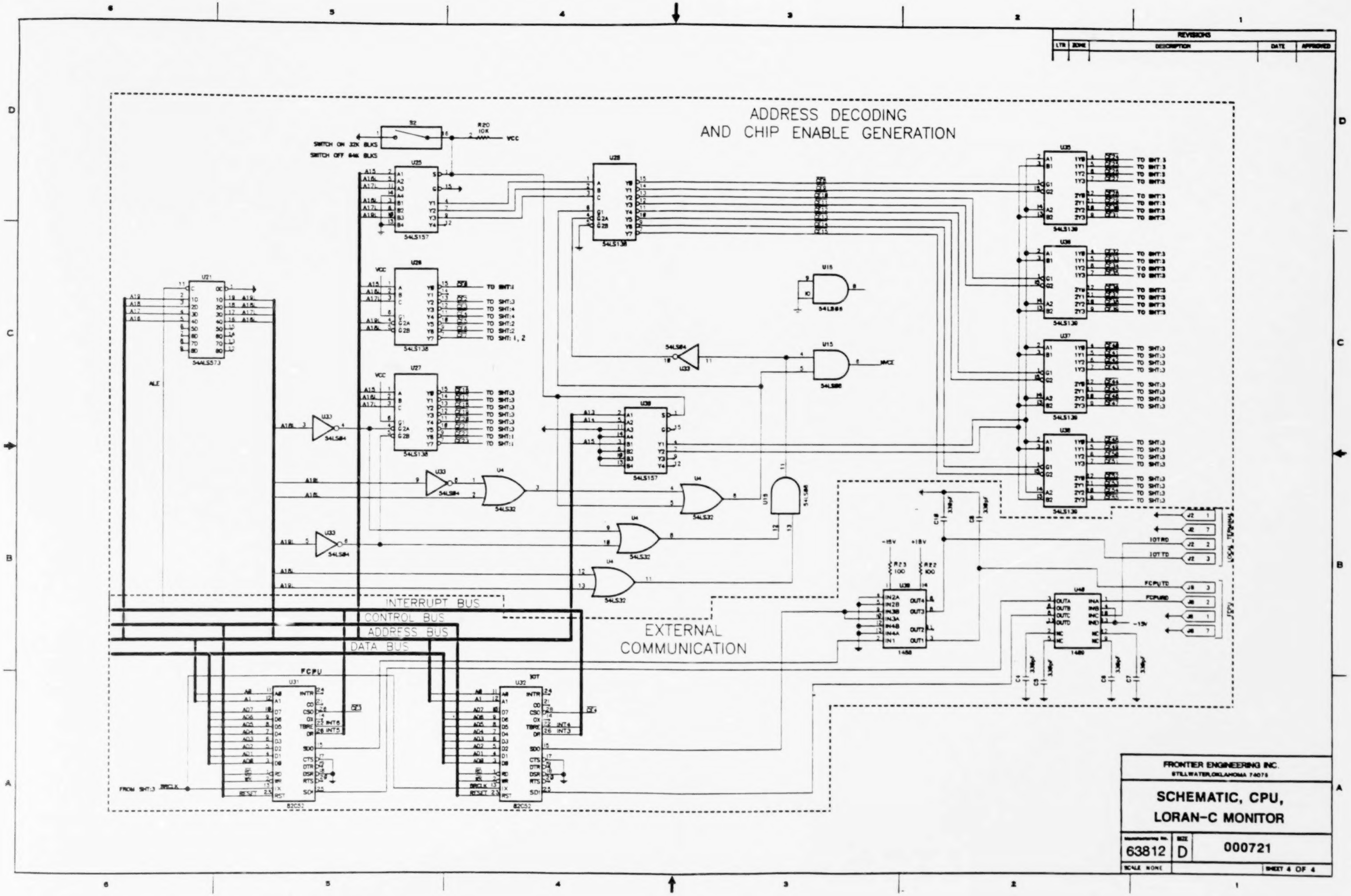
REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED


NONVOLATILE MEMORY
INTERNAL COMMUNICATION
RECEIVER
SIMULATOR
U34
U41
54LS157
U16
74LS74
Y2
K1
K2
Q1
G1

FRONTIER ENGINEERING INC.
STILLWATER,OKLAHOMA 74075

SCHEMATIC, CPU,
LORAN-C MONITOR

	SIZE	
63812	D	000721
SCALE NONE		SHEET 3 OF 4


REVISIONS
LTR
ZONE
DESCRIPTION
DATE
APPROVED
ADDRESS DECODING
AND CHIP ENABLE GENERATION
S2
R20
10K
VCC
SWITCH ON 32K BLKS
SWITCH OFF 64K BLKS
U25
54LS157
U28
54LS138
U21
54ALS573
ALE
U26
54LS138
U27
54LS138
U37
54LS04
U33
54LS04
U4
54LS32
U38
54LS157
U15
54LS08
U35
U36
U37
U38
54LS139
TO SHT:3
TO SHT:4
TO SHT:2
TO SHT:1, 2
NMI
EXTERNAL
COMMUNICATION
INTERRUPT BUS
CONTROL BUS
ADDRESS BUS
DATA BUS
FCPU
U31
82C52
IOT
U32
82C52
FROM SHT:3
U39
1488
U40
1489
-15V
+15V
R23
100
R22
100
IOTRD
IOTTD
FCPUTD
FCPURD
J2
J8

FRONTIER ENGINEERING INC.
STILLWATER,OKLAHOMA 74075

SCHEMATIC, CPU,
LORAN-C MONITOR

63812	D	000721

SCALE NONE

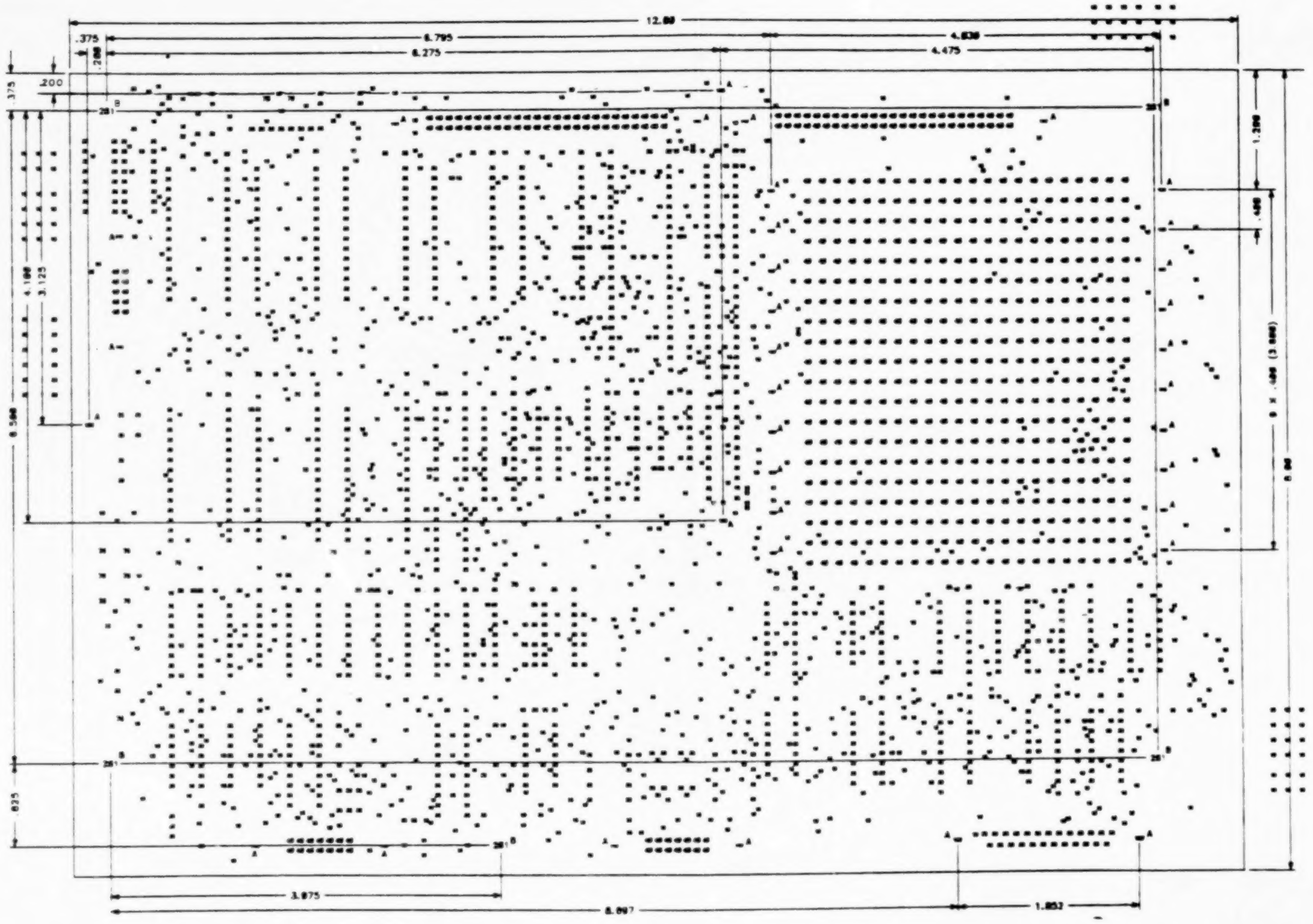
SHEET 4 OF 4

NOTES: UNLESS OTHERWISE SPECIFIED

NOTES:

1. HOLE SIZES ARE AFTER PLATING UNLESS OTHERWISE NOTED.
2. HOLES CODED A ARE NOT PLATED THOUGH
3. HOLE DIAMETER TOLERANCES:
   LESS THAN .100 +.002 −.002,
   GREATER THAN .099 +.005 −.005
4. FINISH: SOLDER COAT OR TIN LEAD PLATE FOLLOWED BY REFLOW PER MIL-STD-275
5. BOARD SHALL BE FREE OF FRAYED AND SHARP EDGES
6. GRID INCREMENTS: .025INCH AT 1=1
7. CONSTRUCTION SHALL CONFORM TO MIL-STD-275 AND MIL-P-55110 WITH THE EXCEPTION THAT PAPER BASE COPPER-CLAD LAMINATES ARE NOT PERMITTED FOR PRINTED WIRING BOARDS PER FAA-G-2100, PARAGRAPH 2.5.5.15.3
8. MATERIALS USED FOR DOUBLE SIDED PRINTED BOARDS SHALL CONFORM TO MIL-P-13949
9. HOLES CODED B ARE NOT PLATED THROUGH HOLE DIAMETER TOLERANCE +.003 −.000

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
F	REV PER E. O. 0431	12/27/88	KAS
G	RELEASE TO PRODUCTION, REV PER ED 0435	1/9/89	



QTY REQD	FSCM NO.	DRAWING OR PART NUMBER	NOMENCLATURE OR DESCRIPTION	SPECIFICATION / MANUFACTURER	REFERENCE DESIGNATOR	ITEM NO.

PARTS LIST

000720	
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMAL DIMENSIONS: HOLE DIAMETER: ANGLES FRACTIONS

MATERIAL: .063 FR4, 1/2oz/ft²

CONTRACT NO: DTFA01-87-C-00006

DRAWN BY: LDC DATE: 12-88

CHECKED BY: DATE:

PROJECT ENGINEER: DATE:

QUALITY CONTROL: DATE:

RELEASED: DATE:

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

TITLE: FABRICATION DWG., CPU, LORAN-C MONITOR

SIZE: D FSCM NO. 63812 DWG NO. 000722

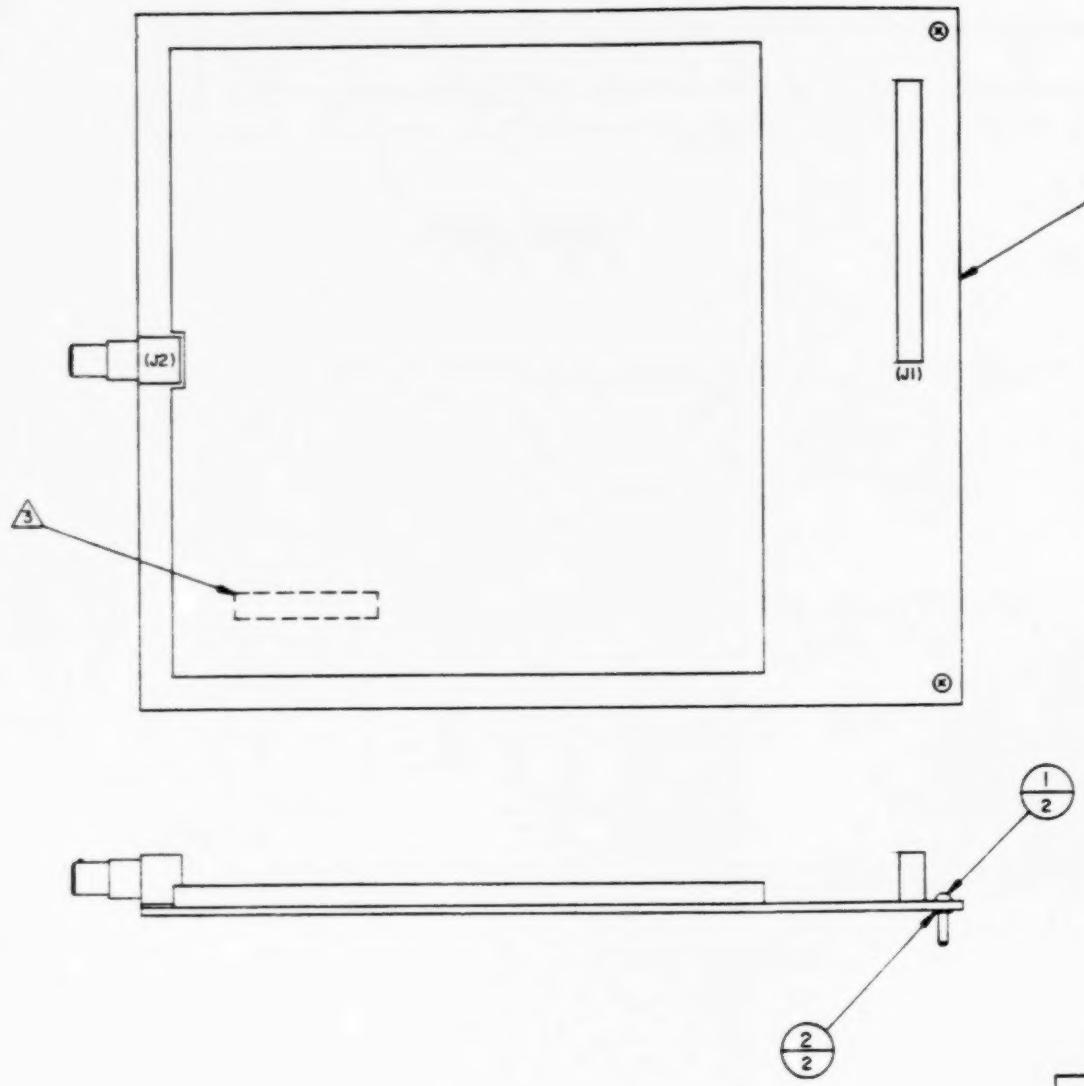
SCALE: NONE SHEET 1 OF 6

NOTES:

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
3. MARK PART NUMBER 63812-000740 WITH APPROPRIATE DASH NUMBER AND REVISION LETTER IN APPROXIMATE LOCATION SHOWN WITH .12 HIGH CHARACTERS USING BLACK EPOXY INK PER FAA-G-2100, PARAGRAPH 3.9
4. SPLIT BALLOON:
   TOP FIGURE IS ITEM NUMBER, BOTTOM NUMBER IS QUANTITY REQUIRED
5. PARANTHETICAL INFORMATION IS FOR REFERENCE USE ONLY

REVISIONS

LTR	ZONE	DESCRIPTION	DATE	APPROVED
A	C4	REMOVED SCREWS, L'WASH, E.O. 0082	2-26-88	
B		REV PER E.O. NO. 0106	3/7/88	
C		REV PER E.O. NO. 0244	5/18/88	
D		REV PER E.O. NO. 0357		
E		REL TO PROD REV PER EO NO 0438	1/5/89	



-1

-2

REF DES	FSCM NO.	QTY REQD -2	QTY REQD -1	DRAWING OR PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO.
	55566	ALT	ALT	RAF-1058-SS	WASHER, SPLIT	RAF ELECTRONIC HDW, INC		2
	55566	ALT	ALT	RAF-830-SS	SCREW, CAPTIVE PANEL	RAF ELECTRONIC HDW, INC		1
RE1	4W731	1	–	10310528	RECEIVER, PCB ASSY	ANI		4
U1	4W731	–	1	10310529	SIMULATOR, PCB ASSY	ANI		3
	61000	2	2	SS-13001	WASHER, SPLIT	GLOBE FASTENERS		2
	61000	2	2	SS-10730	SCREW, CAPTIVE PANEL	GLOBE FASTENERS		1

PARTS LIST

APPLICATION
NEXT ASSY 000700
END ITEM CODE NO.

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
MATERIAL

1-15-88
RCD
1/17/88

CONTRACT NO. DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

ASSY, RECEIVER/SIMULATOR, LORAN-C MONITOR

63812 | SIZE D | 000740

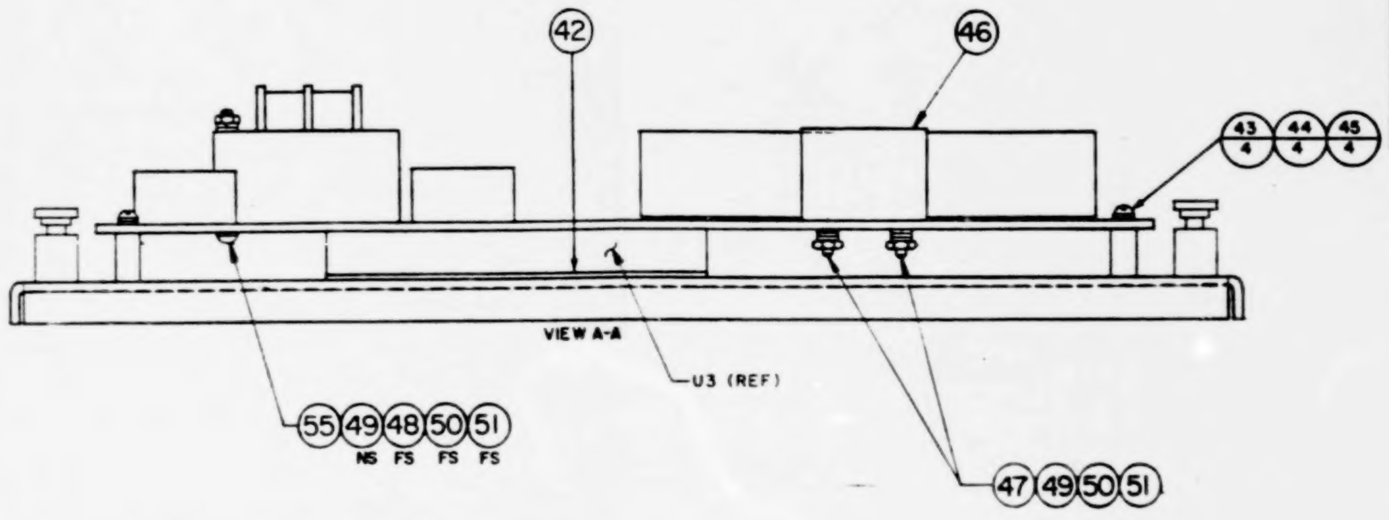
SCALE NONE | SHEET 1 OF 1

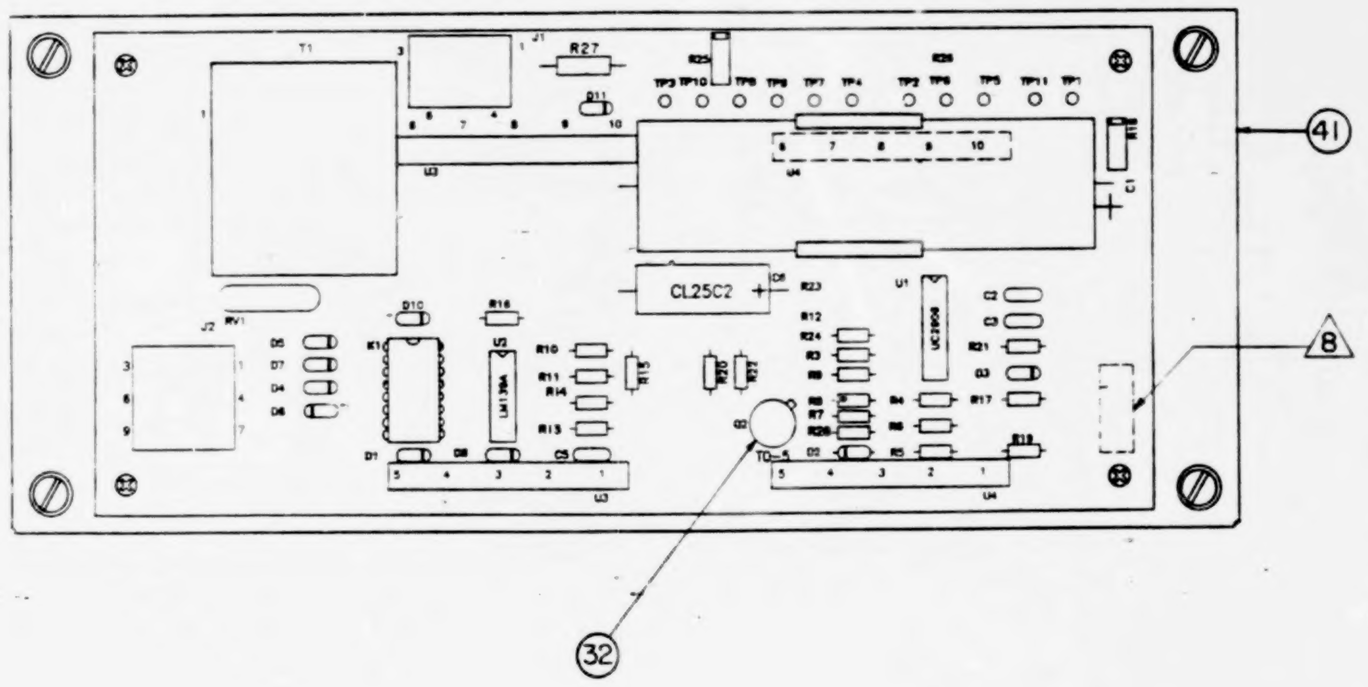
NOTES:

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
3. REFERENCE DESIGNATORS NOT USED: D9, Q1,R1,R2,C4
4. HIGHEST REFERENCE DESIGNATOR USED ARE: TP11 R28,D11,Q2,C6,K1, RV1, J2, T1, U4
5. PREFIX ALL REFERENCE DESIGNATORS WITH A2
6. LOCATIONS R23, R26, R12 AND U4 FOR FUTURE EXPANSION, DO NOT INSTALL COMPONENTS IN THESE LOCATIONS
7. SPLIT BALLOON: TOP FIGURE IS ITEM NUMBER, BOTTOM FIGURE IS QUANTITY REQUIRED
8. MARK SERIAL NUMBER IN LOCATION SHOWN
9. SOLDER PER MIL-STD-454, REQUIREMENT 5 USING ITEM 54
10. APPLY THERMAL COMPOUND TO ENTIRE FACE OF U3 PER MFG SPECIFICATION BEFORE MOUNTING BRACKET

REVISIONS

LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REV PER E.O. NO. 0076	2-26-88	MKM
B		REV PER E.O. NO. 0216	5/13/88	[illegible]
C		REV PER E.O. NO. 0258	[illegible]	[illegible]
D		REV PER E.O. NO. 0289	[illegible]	[illegible]
E		REV PER E.O. NO. 0334	[illegible]	[illegible]
F		REL TO PROD. REV PER E.O. NO. 0439	[illegible]	[illegible]
G		REV PER E.O. NO. 0487	[illegible]	[illegible]
H		REV PER E.O. NO. 0501	[illegible]	[illegible]


42
46
43/4
44/4
45/4
VIEW A-A
U3 (REF)
55
49 NS
48 FS
50 FS
51 FS
47
49
50
51


T1
J1
R27
R25
R26
TP3 TP10 TP8 TP6 TP7 TP4 TP2 TP9 TP5 TP11 TP1
41
U3
U4
C1
CL25C2
R23
U1
R12
R24
R3
R22
C2
R21
Q3
R17
8
RV1
J2
R10
R16
K1
D5
D7
D4
D6
U5
R9
R11
R14
R13
R4
R7
R8
R6
R5
R15
D1
D3
D2
D8
C5
TO-5
32

SEE PARTS LIST PL000750

QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MATERIAL	SPECIFICATION	ITEM NO.

PARTS LIST

APPLICATION
NEXT ASSY
000700
END ITEM USED ON

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PLACE DECIMALS ± .01
3 PLACE DECIMALS ± .005
FRACTIONS ± 1/16
ANGLES ± 0°30'
MATERIAL

ORIGINAL DATE OF DRAWING 2-3-88
CHECKED 2/4/88
APPROVED 2/4/88
CONTRACT NO. DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

PC ASSY, POWER SUPPLY,
LORAN-C MONITOR

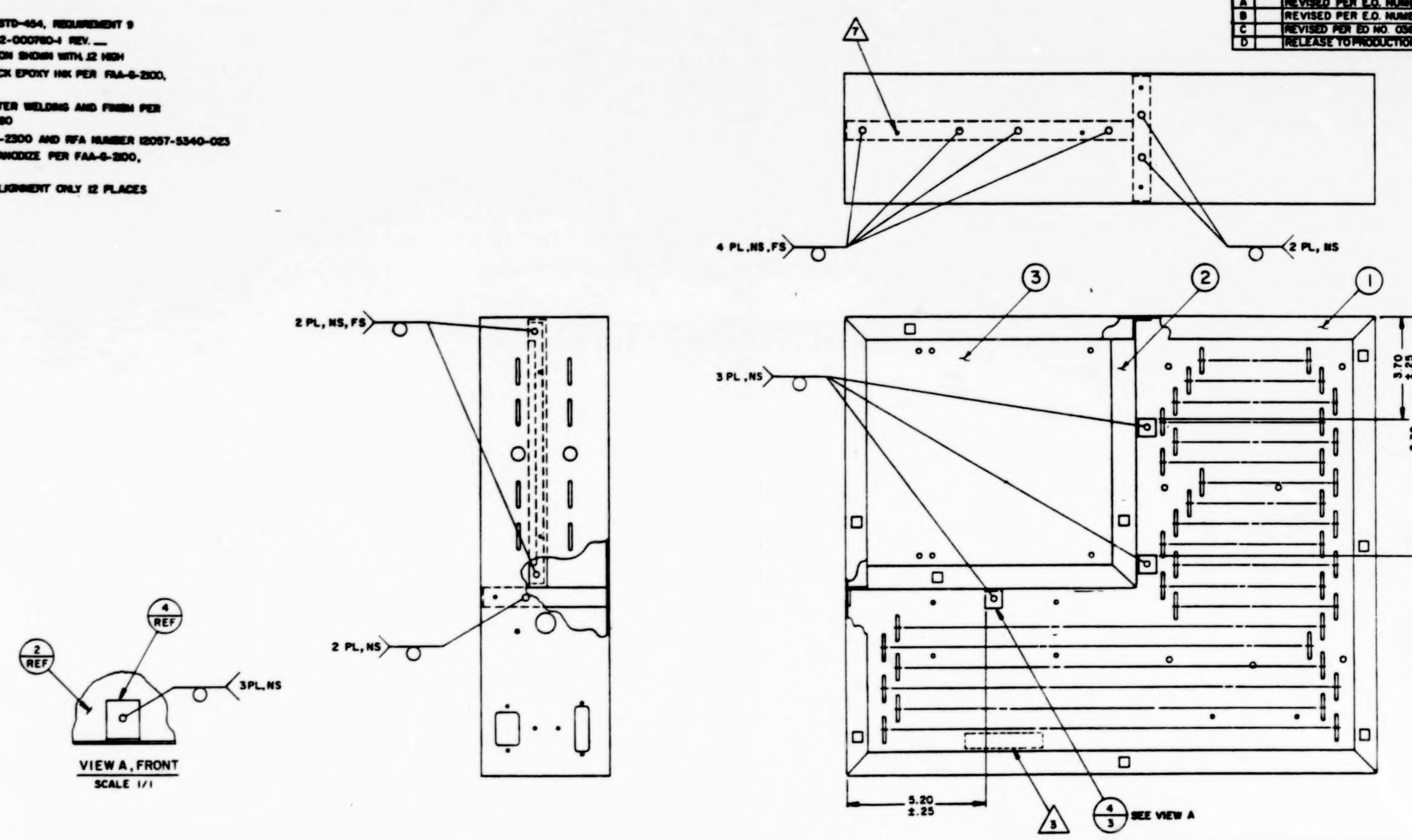
MANUFACTURING NO. 63812 SIZE D 000750
SCALE NONE SHEET 1 OF 1

NOTES:

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
3. MARK PART NUMBER 63812-000760-1 REV. __ IN APPROXIMATE LOCATION SHOWN WITH .12 HIGH CHARACTERS USING BLACK EPOXY INK PER FAA-G-2100, PARAGRAPH 3.9
4. INSTALL HARDWARE AFTER WELDING AND FINISH PER 000870, 000880, 000890
5. SPOT WELD PER FAA-G-2300 AND RFA NUMBER 12057-5340-023
6. CHEM FILM OR CLEAR ANODIZE PER FAA-G-2100, PARAGRAPH 3.7.6.2
7. .125 DIA. HOLES FOR ALIGNMENT ONLY 12 PLACES

REVISIONS

LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REVISED PER E.O. NUMBER 0037	1/13/88	
B		REVISED PER E.O. NUMBER 0067 & 0083	2/18/88	MBM
C		REVISED PER EO NO. 0365		
D		RELEASE TO PRODUCTION, REV PER EO 0443	1/15/89	



FSCM NO.	QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO.
	3	000875-1	BRACKET, CHASSIS			4
	1	000890-1	BRACKET, SEPARATOR			3
	2	000880-1	BRACKET, INNER			2
	1	000870-1	CHASSIS			1

PARTS LIST

APPLICATION
NEXT ASSY
000700

11-14-87
RD

DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

CHASSIS ASSEMBLY, LORAN-C MONITOR

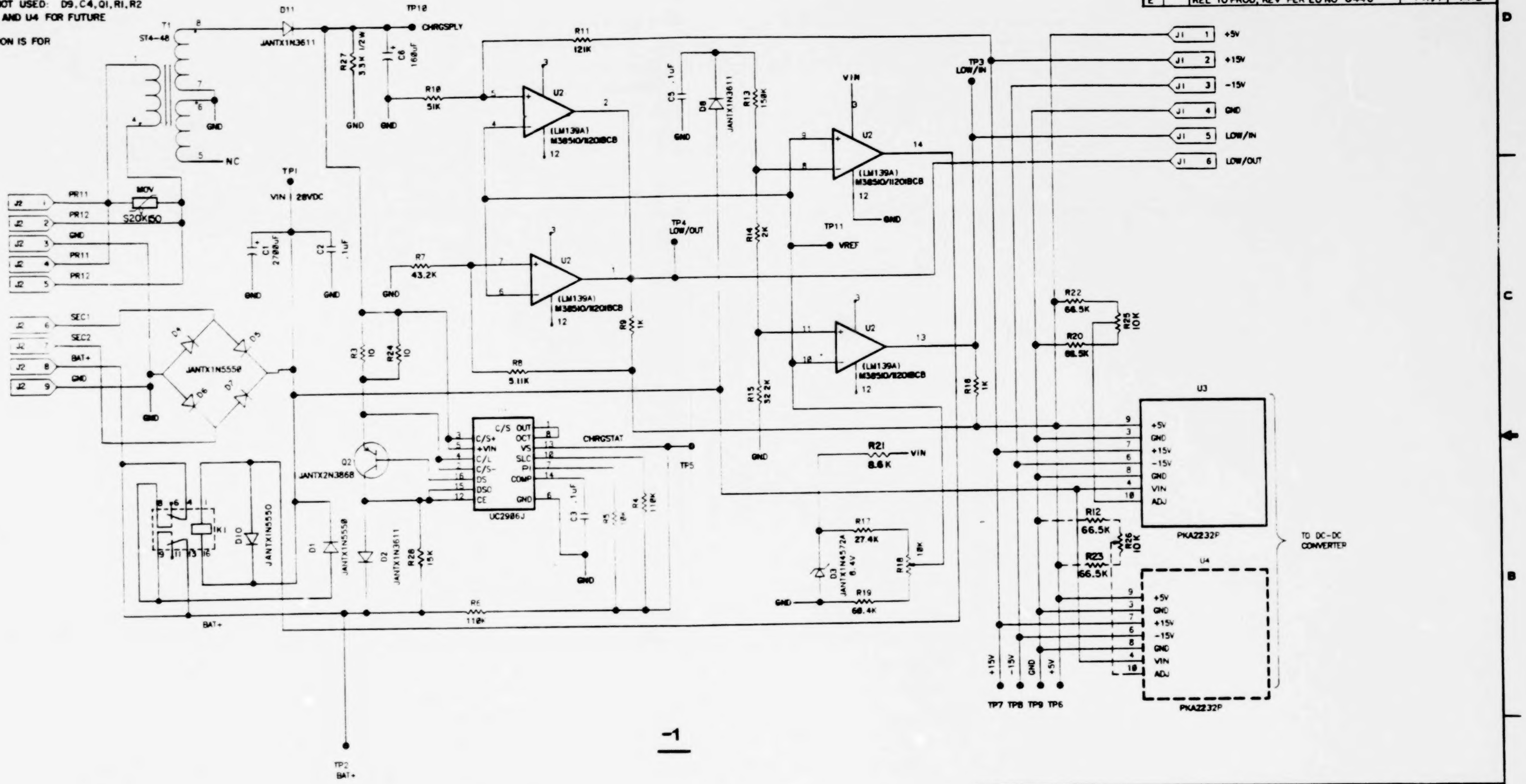
63812 | D | 000760

SCALE 1/2 | SHEET 1 OF 1

NOTES:

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. ALL RESISTANCE IN OHMS
3. FOR COMPLETE REFERENCE DESIGNATIONS PREFIX ALL DESIGNATOR WITH: A2
4. HIGHEST REFERENCE DESIGNATIONS USED ARE: R28, D11, Q2, C6, U4, TP11, T1, RV1, AND J3
5. REFERENCE DESIGNATORS NOT USED: D9, C4, Q1, R1, R2
6. COMPONENT R23, R26, R12 AND U4 FOR FUTURE EXPANSION
7. PARENTHETICAL INFORMATION IS FOR REFERENCE ONLY

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REV PER E.O. NO. 0068	[illegible]	[illegible]
B		REV PER EO NO 0149	[illegible]	[illegible]
C		REV PER EO NO 0257	[illegible]	[illegible]
D		REV PER E.O. NO. 0291	[illegible]	[illegible]
E		REL TO PROD, REV PER EO NO 0440	1/5/89	[illegible]


T1
ST4-48
D11
JANTX1N3611
TP10
CHRGSPLY
R27
33K 1/2W
C6
160uF
GND
NC
R11
121K
R10
51K
U2
(LM139A)
M38510/11201BCB
C5 .1uF
D8
JANTX1N3611
R13
158K
VIN
TP3
LOW/IN
J1 1 +5V
J1 2 +15V
J1 3 -15V
J1 4 GND
J1 5 LOW/IN
J1 6 LOW/OUT
TP1
VIN | 28VDC
J2 1 PR11
J2 2 PR12
J2 3 GND
J2 4 PR11
J2 5 PR12
MOV
S20K50
C1
2700uF
C2 .1uF
R7
43.2K
TP4
LOW/OUT
R14
2K
TP11
VREF
R22
66.5K
R25
10K
R20
66.5K
J2 6 SEC1
J2 7 SEC2
BAT+
J2 8 GND
J2 9
D4 D5 D6 D7
JANTX1N5550
R3
10
R24
10
R9
1K
R8
5.11K
R15
32.2K
R18
1K
U3
Q2
JANTX2N3868
UC2906J
C/S OUT
C/S+
+VIN
C/L
C/S-
DS
DSO
CE
OCT
VS
SLC
PI
COMP
GND
CHRGSTAT
TP5
R21
8.6K
+5V
GND
+15V
-15V
VIN
ADJ
PKA2232P
K1
D10
JANTX1N5550
D1
JANTX1N5550
D2
JANTX1N3611
R28
15K
C3 .1uF
R5
R4
11K
R17
27.4K
D3
JANTX1N4572A
6.4V
R16
10K
R19
60.4K
R12
66.5K
R23
66.5K
R26
10K
TO DC-DC CONVERTER
U4
R6
110
BAT+
TP7 TP8 TP9 TP6
TP2
BAT+
-1

QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MATERIAL	SPECIFICATION	ITEM NO.

PARTS LIST

APPLICATION
NEXT ASSY
000750

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
MATERIAL

3/28/87

FRONTIER ENGINEERING INC.
STILLWATER,OKLAHOMA 74075

SCHEMATIC, POWER SUPPLY
LORAN-C MONITOR

63812 | D | 000751

12/10/87

DTFA01-87-C-00006

SCALE NTS

SHEET 1 OF 1

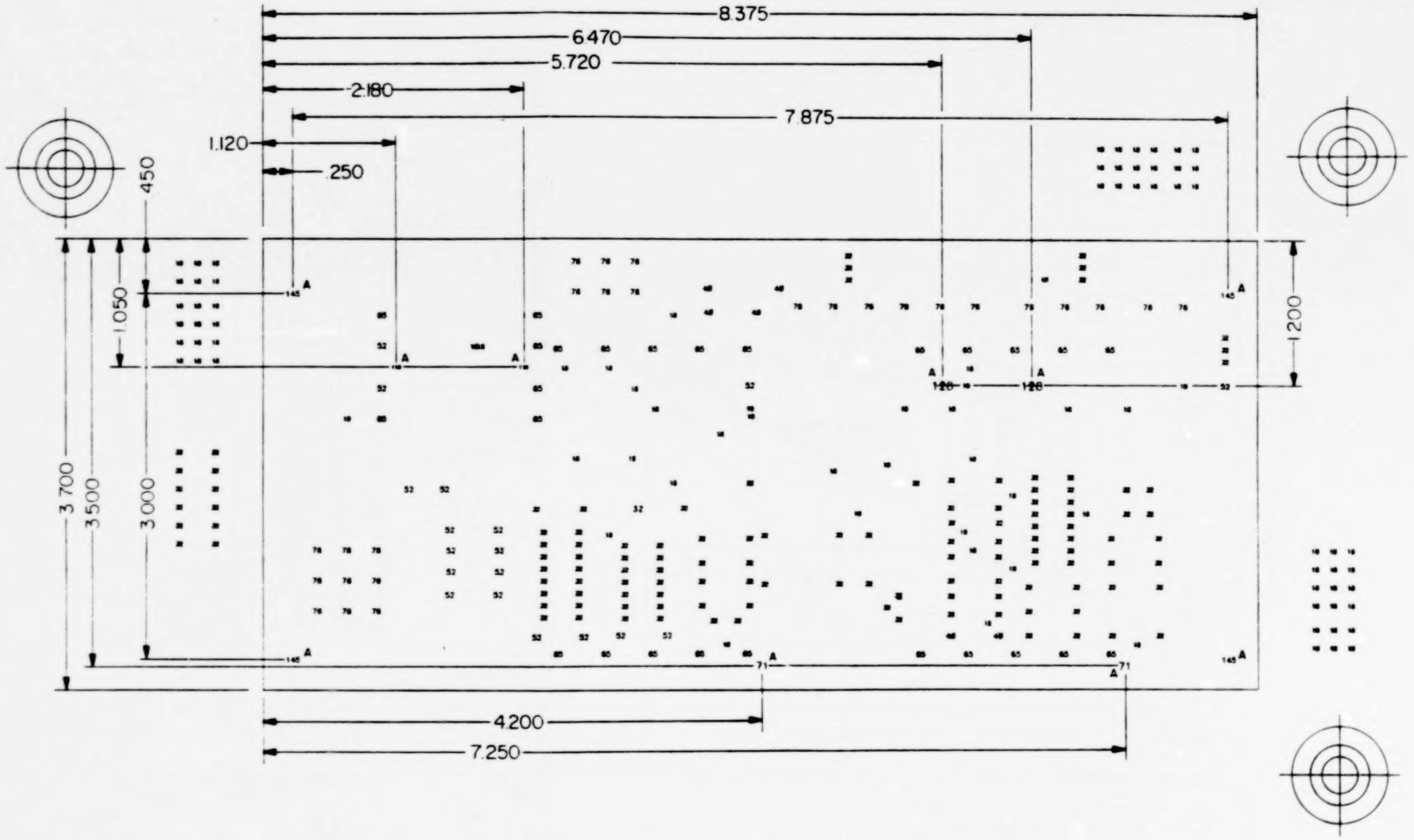
NOTES: UNLESS OTHERWISE SPECIFIED

NOTES:

1. HOLE SIZES ARE AFTER PLATING UNLESS OTHERWISE SPECIFIED
2. HOLE DIAMETER TOLERANCES:
   LESS THAN .100 +.003 -.003
   GREATER THAN .099 +.005 -.005
3. HOLES CODED A ARE NOT PLATED THROUGH
4. GRID INCREMENT: .025 INCH AT 1=1
5. MATERIAL USED FOR DOUBLE SIDED PRINTED CIRCUIT BOARDS SHALL BE CONFORM TO MIL-P-13949
6. CONSTRUCTION SHALL CONFORM TO MIL-STD-275 AND MIL-P-55110 WITH THE EXCEPTION THAT PAPER BASE COPPER-CLAD LAMINATES ARE NOT PERMITTED FOR PRINTED WIRING BOARDS PER FAA-G-2100, PARAGRAPH 3.5.5.15.3
7. BOARD TO BE FREE OF FRAYED AND SHARP EDGES
8. FINISH: SOLDER COAT OR TIN LEAD PLATE FOLLOWED BY REFLOW PER MIL-STD-275
9. TOLERANCES:
   2 PLACE DECIMAL: +.020 -.020
   3 PLACE DECIMAL: +.010 -.010

REVISIONS

REV	DESCRIPTION	DATE	APPROVED
D	REV AS PER E.O. 0044	4-25-88	KAS
E	REV AS PER E.O. 0046	2-1-88	KAS
F	REV AS PER E.O. 0309	9/11/88	MPS
G	REV PER EO # 0879	[illegible]	MPS
H	RELEASE TO PRODUCTION, REV PER EO 0441	1/5/89	[illegible]



QTY REQD	FSCM NO.	DRAWING OR PART NUMBER	NOMENCLATURE OR DESCRIPTION	SPECIFICATION / MANUFACTURER	REFERENCE DESIGNATOR	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.

CONTRACT NO. DTFA01-87-C-00006

DRAWN BY MP

CHECKED BY MPS

PROJECT ENGINEER KAS

QUALITY CONTROL

RELEASED

MATERIAL .063 FR4 1/2 oz/ft²

000750

NEXT ASSY | USED ON

APPLICATION

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

TITLE
FABRICATION DWG,
POWER SUPPLY,
LORAN-C MONITOR

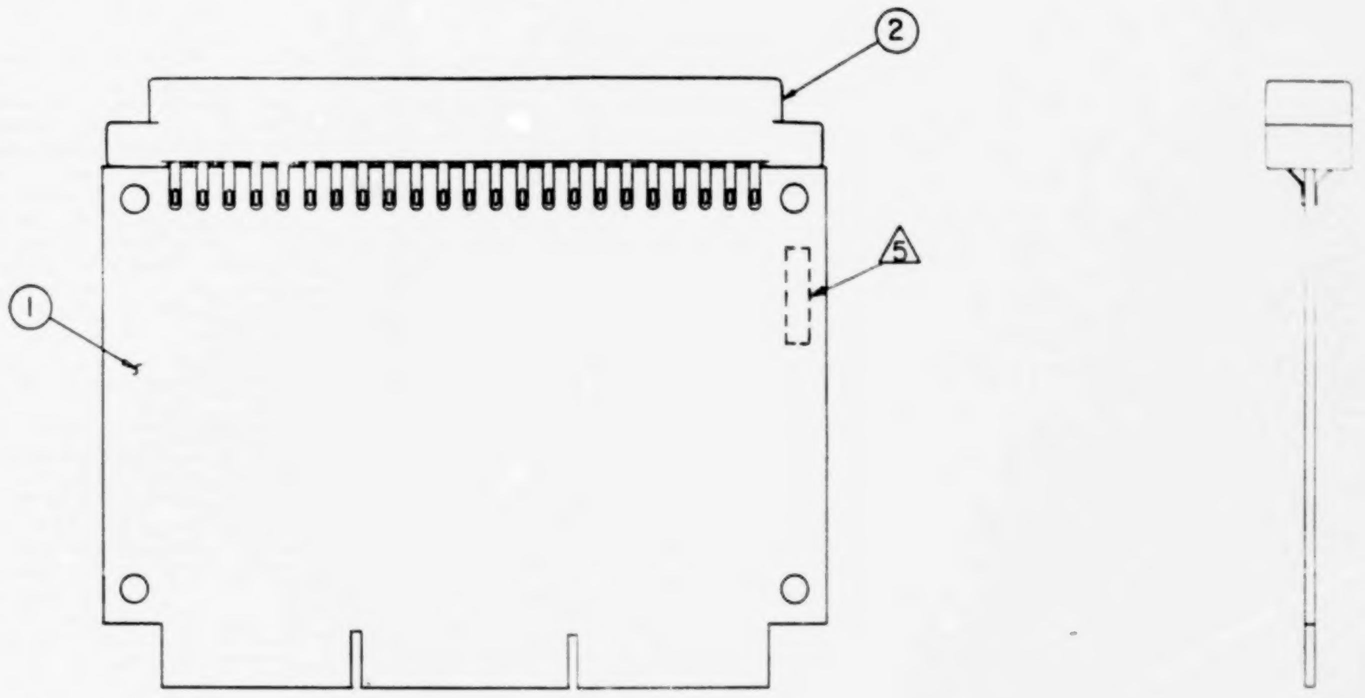
SIZE D | FSCM NO. 63812 | DWG NO. 000752

SCALE NONE | SHEET 1 OF 6

NOTES:
1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
3. PREFIX ALL REFERENCE DESIGNATORS WITH A4
4. SOLDER PER MIL-STD-454, REQUIREMENT 5, USING ITEM 3
5. ~~ENGRAVE SERIAL NUMBER IN LOCATION SHOWN~~ OR MARK SERIAL NUMBER IN LOCATION SHOWN WITH .12 HIGH CHARACTERS USING BLACK EPOXY INK PER FAA-G-2100, PARAGRAPH 3.9

REVISIONS

LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REV PER E.O. NO. 0105	[illegible]	[illegible]
B		REVISED PER EO NO. 0164	[illegible]	[illegible]
C		REVISED PER EO NO. 0301	[illegible]	[illegible]
D		REVISED PER E.O. NO. 0366	[illegible]	[illegible]
E		REL. TO PROD., REV PER E.O. NO. 0442	1/5/89	[illegible]
F		REV PER EO 0504	2/24/89	[illegible]
G		REV PER EO 0522	3/16/89	[illegible]



REF. DES.	FSCM NO.	QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO.
		REF	117AT003	PROCEDURE, ACCEPTANCE TEST			5
		REF	000771-1	SCHEMATIC, EXTENDER			4
	81348	AR	SN63BS	SOLDER		QQ-S-571	3
P1	71785	1	009-00328-7	CONNECTOR, RECEPTACLE	TRW		2
		1	000772-1	EXTENDER BOARD			1

PARTS LIST

APPLICATION
NEXT ASSY
000700

END ITEM CODE NO.

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:

MATERIAL

3/10/88
DT

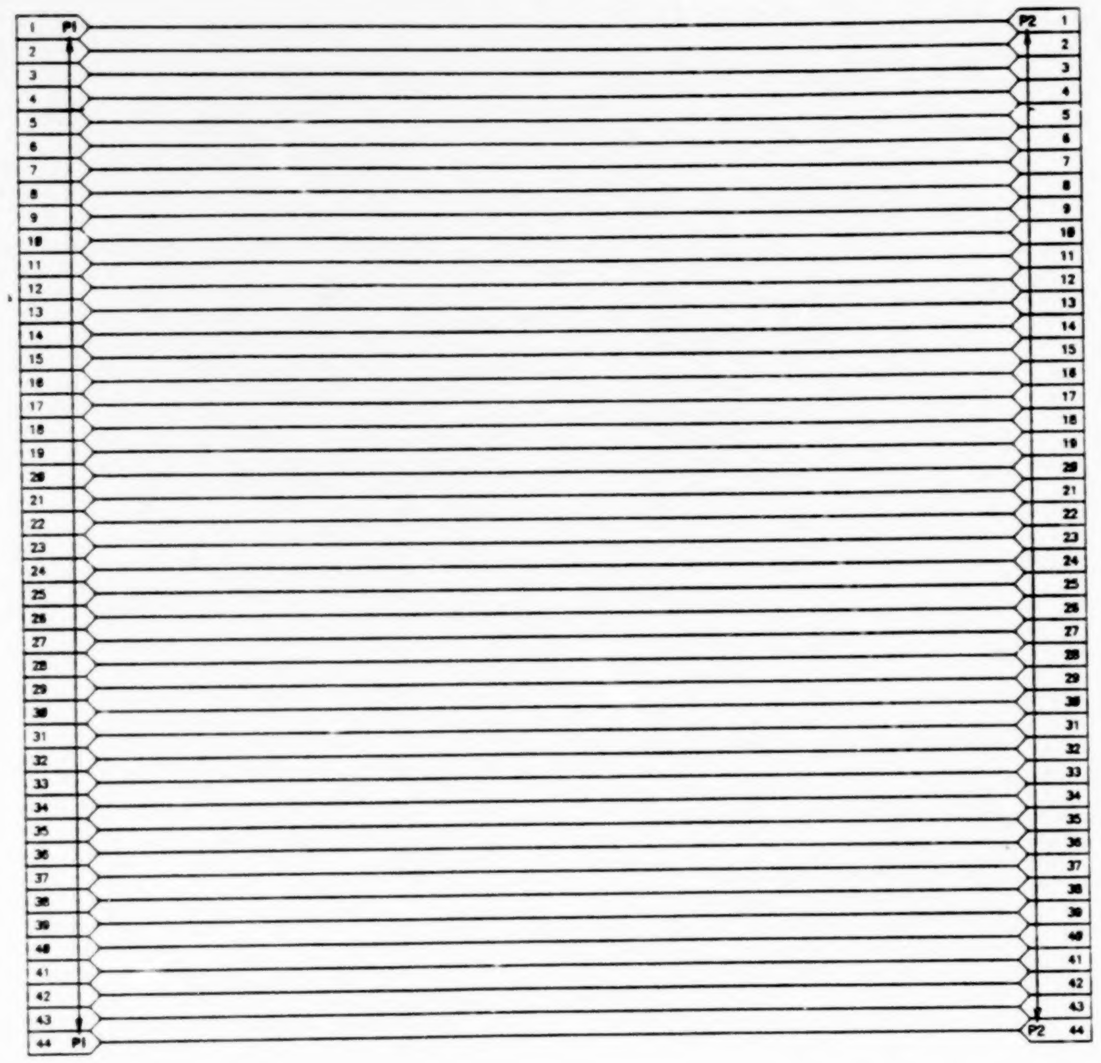
DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

PC ASSY, EXTENDER,
LORAN-C MONITOR

63812
SIZE D
000770
SCALE NONE
SHEET 1 OF 1

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REL. TO PROD., REV PER E.O. NO. 0444	1/5/[illegible]	


P1
P2
1
2
3
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17
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20
21
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42
43
44
P1
P2

NOTES:
1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ALL DESIGNATORS WITH: A4
3. HIGHEST REFERENCE DESIGNATION USED: P2

QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MATERIAL	SPECIFICATION	ITEM NO.

PARTS LIST

APPLICATION
NEXT ASSY
000770

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
FRACTIONS ± 1/64

MATERIAL

CONTRACT NO.
DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

SCHEMATIC, EXTENDER,
LORAN-C MONITOR

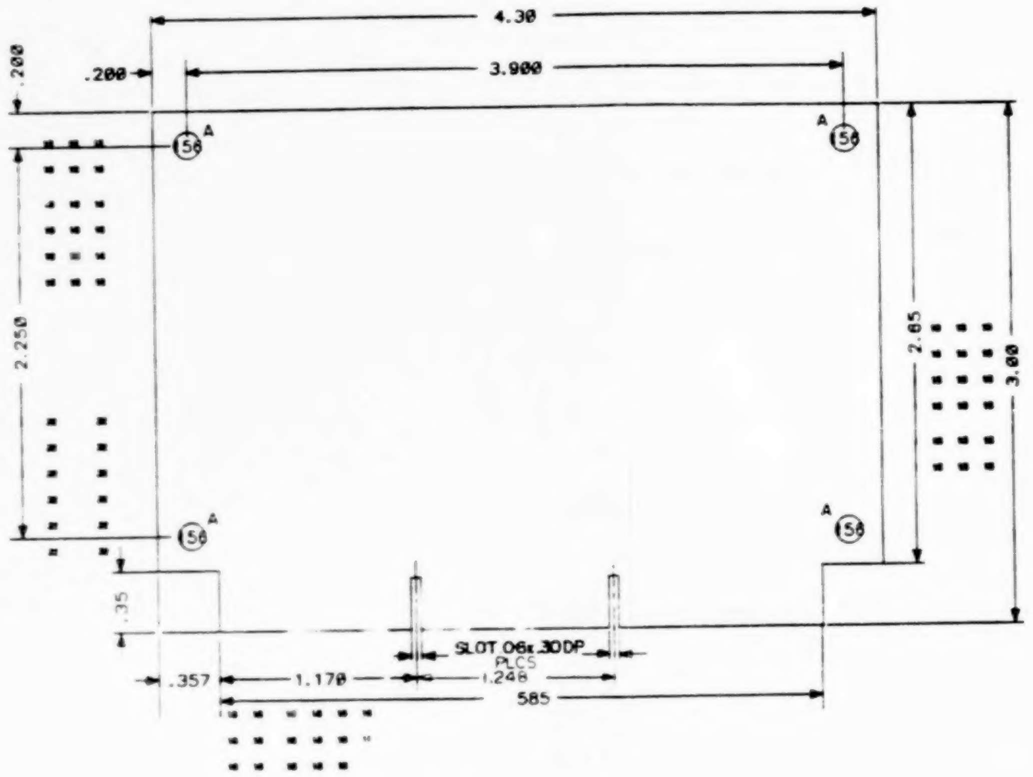
63812
SIZE D
000771
SCALE NTS
SHEET 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED

NOTES:

1. HOLE SIZES ARE AFTER PLATING UNLESS OTHERWISE SPECIFIED
2. HOLE DIAMETER TOLERANCES:
   LESS THAN .100 +.002 -.002
   GREATER THAN .099 +.005 -.005
3. HOLES CODED A ARE NOT PLATED THROUGH
4. GRID INCREMENT: .025 INCH AT 1=1
5. MATERIAL USED FOR DOUBLE SIDED PRINTED CIRCUIT BOARDS SHALL BE CONFORM TO MIL-P-13949
6. CONSTRUCTION SHALL CONFORM TO MIL-STD-275 AND MIL-P-55110 WITH THE EXCEPTION THAT PAPER BASE COPPER-CLAD LAMINATES ARE NOT PERMITTED FOR PRINTED WIRING BOARDS PER FAA-G-2100, PARAGRAPH 3.5.5.15.3
7. BOARD TO BE FREE OF FRAYED AND SHARP EDGES
8. FINISH: SOLDER COAT OR TIN LEAD PLATE FOLLOWED BY REFLOW PER MIL-STD-275
9. TOLERANCES:
   2 PLACE DECIMAL: +.020 -.020
   3 PLACE DECIMAL: +.010 -.010
10. CONNECTOR AREA SHALL BE GOLD PLATED OVER LOW-STRESS NICKEL ON BOTH SIDES PER MIL-STD-275
11. KEY SLOT SHALL LOCATED SYMMETRICALLY ABOUT CENTERLINE AS SHOWN

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	REV. AS PER E.O 0047	2-2-88	
B	REV. AS PER E.O 0051	2-3-88	
C	REV AS PER E.O 0103	3-14-88	
D	REV AS PER E.O 0311		
E	REV PER E.O. 0382		
F	REL TO PROD. REV PER E.O NO. 0445		



DRILL CHART

QTY REQD	FSCM NO.	DRAWING OR PART NUMBER	NOMENCLATURE OR DESCRIPTION	SPECIFICATION / MANUFACTURER	REFERENCE DESIGNATOR	ITEM NO.

PARTS LIST

000770	
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMAL DIMENSIONS: .XX = ±.020 .XXX = ±.010 HOLE DIAMETER UP TO .500 +.005 OVER .500 +.005 ANGLES ±1° 00' FRACTIONS ±1/32

MATERIAL .063 FR4 1/2 oz/ft²

CONTRACT NO. DTFA01-87-C-00006

DRAWN BY DH

CHECKED BY LF

PROJECT ENGINEER KHS

QUALITY CONTROL

RELEASED

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

TITLE FABRICATION DWG,
EXTENDER,
LORAN-C MONITOR

SIZE D FSCM NO. 63812 DWG NO. 000772

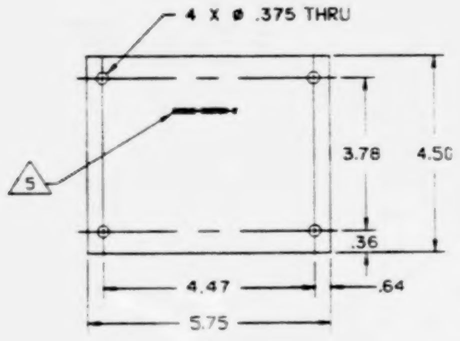
SCALE

SHEET 1 of 6

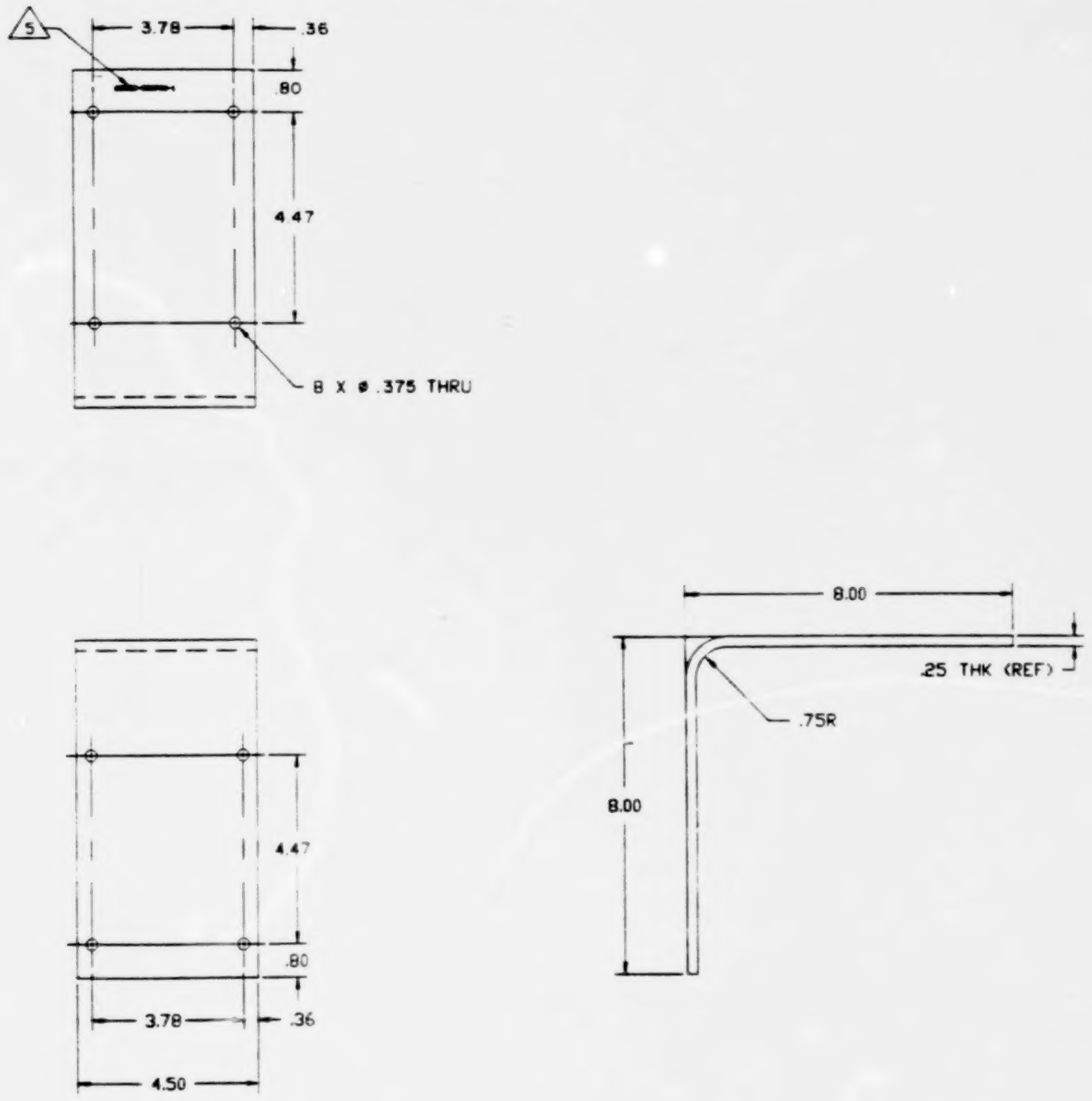
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	REV PER E.O. 0545	4/20/??	

NOTES: UNLESS OTHERWISE SPECIFIED

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
3. MATERIAL: AL. 5052-H32, .25 THK PER QQ-A-250/8
4. FINISH: CHEMICAL FILM PER MIL-C-5541, CLASS 3
5. MARK .12 HIGH CHARACTERS IN LOCATION SHOWN AFTER FINISHING USING BLACK EPOXY INK



-2



-1

QTY REQD	FSCM NO.	DRAWING OR PART NUMBER	NOMENCLATURE OR DESCRIPTION	SPECIFICATION / MANUFACTURER	REFERENCE DESIGNATOR	ITEM NO.
PARTS LIST						

NEXT ASSY	USED ON
000830	
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMAL DIMENSIONS: .XX = ±.030 .XXX = ±.010 HOLE DIAMETER: UP TO .500 +.005 OVER .500 +.008 ANGLES ±1° 00' FRACTIONS ±1/32

MATERIAL

CONTRACT NO. DTFA01-87-C-00006

		DATE
DRAWN BY		
CHECKED BY	W Hood	
PROJECT ENGINEER		
QUALITY CONTROL		
RELEASED		

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

TITLE
PLATE, COUPLER

SIZE	FSCM NO.	DWG NO.
D	63812	000780

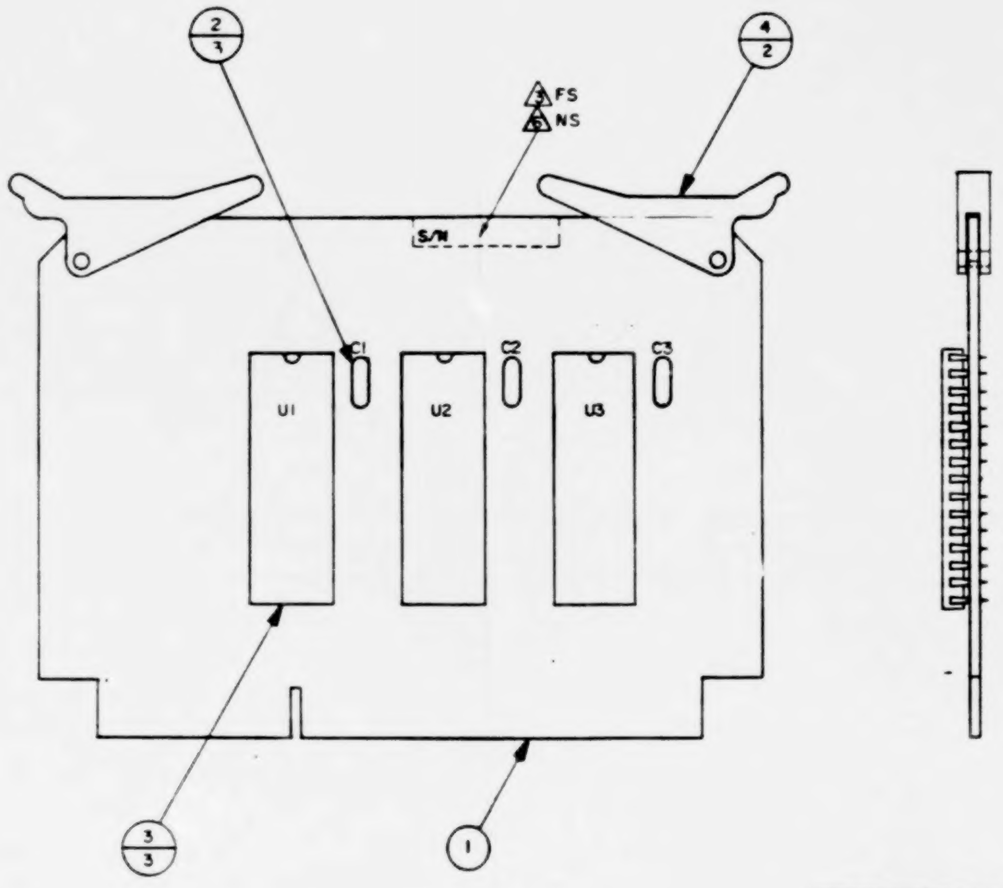
SCALE NONE
SHEET 1 OF 1

NOTES

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
3. MARK PART NUMBER 63812-000790-1 AND APPROPRIATE REV. LETTER IN POSITION SHOWN, REV G AND LATER
4. HIGHEST REF DES. USED ARE: U3, C3
5. PREFIX ALL REF DES WITH A4
6. MARK SERIAL NUMBER IN LOCATION SHOWN
7. SPLIT BALLOON: TOP FIGURE IS ITEM NUMBER, BOTTOM FIGURE IS QUANTITY REQUIRED
8. SOLDER PER MIL-STD-454, REQUIREMENT 5 USING ITEM NO. 6

REVISIONS

LTR	ZONE	DESCRIPTION	DATE	APPROVED
A	D3	REV AS PER E.O. 0180	[illegible]	[illegible]
B	B2	REV AS PER E.O. 0281	[illegible]	[illegible]
C	D6	REV AS PER E.O. NO. 0363		
D	A1	RELEASE TO PRODUCTION, REV PER EO 0446	[illegible]	[illegible]
E		REV PER E.O. NO. 0488	[illegible]	[illegible]
F	D6	REV PER E.O. NO. 0500	[illegible]	[illegible]
G	–	REV PER E.O. NO. 0550	[illegible]	[illegible]



-1

REF DES	FSCM NO.	QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO.
C1-C3	81349	ALT	M39014/01-1553	CAPACITOR, .1µf		M39014/ 1	2
U1-U3	60395	ALT	X2864ADMB-35	EEPROM	XICOR, INC		3
		REF	117AT003	PROC, ACCEPTANCE TEST			7
	81384	AR	SN63BS	SOLDER		QQ-S-571	6
		REF	000791	SCHEMATIC			5
	22089	2	EJ-2001-W	EJECTOR, CIRCUIT CARD	ELECTRO-SPACE FABRICATORS		4
U1-U3	60395	3	X2864ADMB-45	EEPROM	XICOR, INC		3
C1-C3	81349	3	M39014/01-1554	CAPACITOR, .1µf		M39014/ 1	2
		1	000792	PRINTED WIRING BOARD			1

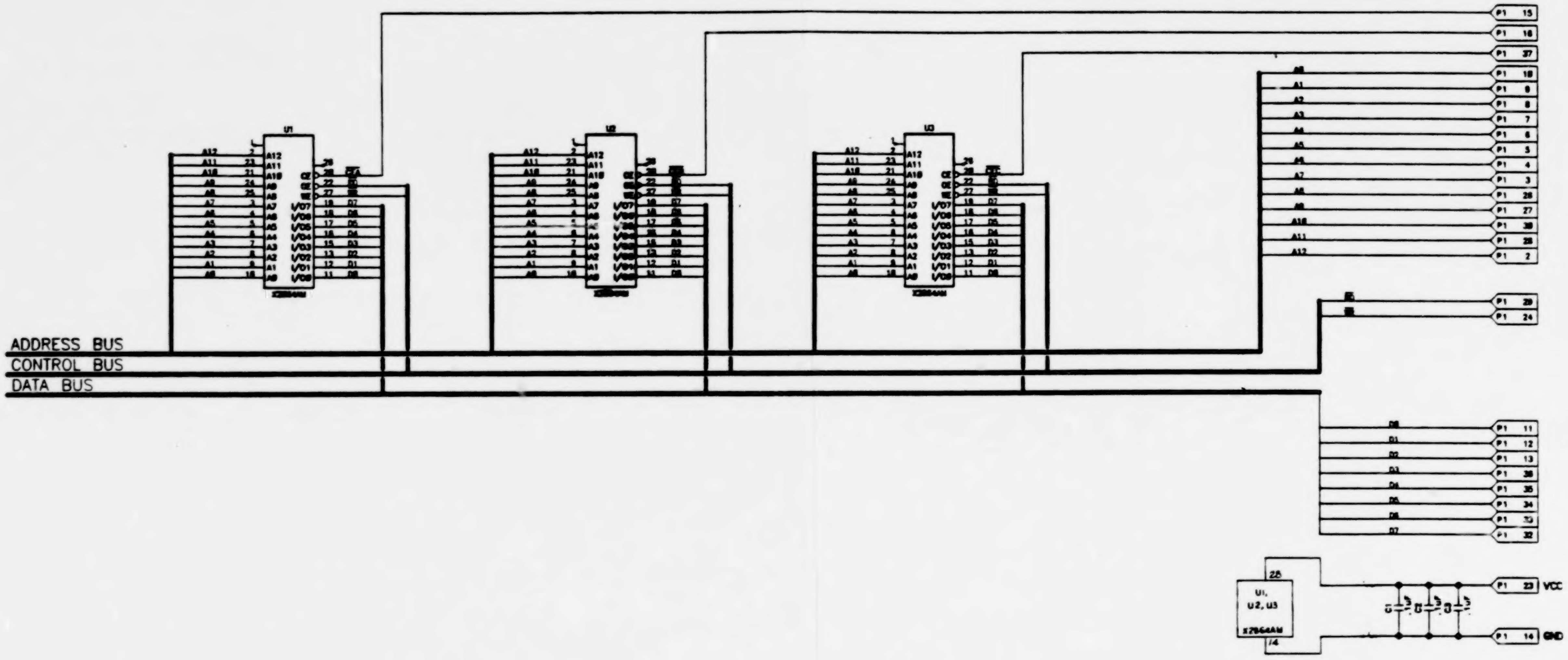
PARTS LIST

APPLICATION NEXT ASSY 000700	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: 2 PLACE DECIMALS ± .01 3 PLACE DECIMALS ± .005 FRACTIONS ± 1/16 ANGLES ± 0°30'	ORIGINAL DATE OF DRAWING 11-14-87	FRONTIER ENGINEERING INC. STILLWATER, OKLAHOMA 74075
		DRAFTSMAN LDC CHECKED KF	PC ASSY, EEPROM MODULE, LORAN-C MONITOR
	MATERIAL N/A	ENGINEER	
		APPROVED [illegible] 3/14/??	
END ITEM CODE NO.		APPROVED Paul D. [illegible] 3/14/88	MANUFACTURING NO. 63812 · SIZE D · 000790
		CONTRACT NO. DTFA01-87-C-00006	SCALE 2/1 · SHEET 1 OF 1

NOTES:

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ALL DESIGNATORS WITH: A3
3. HIGHEST REFERENCE DESIGNATION USED: U3, C3

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REVISED PER ED NO. 375		
B		REL. TO PROD, REV PER E.O. NO. 0446	1/5/87	


U1
U2
U3
X2864AM
A12
A11
A10
A9
A8
A7
A6
A5
A4
A3
A2
A1
A0
CE
OE
WE
I/O7
I/O6
I/O5
I/O4
I/O3
I/O2
I/O1
I/O0
D0
D1
D2
D3
D4
D5
D6
D7
ADDRESS BUS
CONTROL BUS
DATA BUS
P1
U1, U2, U3
28
14
VCC
GND

PARTS LIST

QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MATERIAL	SPECIFICATION	ITEM NO.

APPLICATION

NEXT ASSY 000790

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES

TOLERANCES ON:

2 PLACE DECIMALS ± .01

3 PLACE DECIMALS ± .005

FRACTIONS ± 1/16

ANGLES ± 0°30'

MATERIAL

7/8/88

CONTRACT NO. DTFA01-87-C-00008

FRONTIER ENGINEERING INC.

STILLWATER, OKLAHOMA 74075

SCHEMATIC,
EEPROM MODULE
LORAN-C MONITOR

63812 | SIZE D | 000791

SCALE NTS

SHEET 1 OF 1

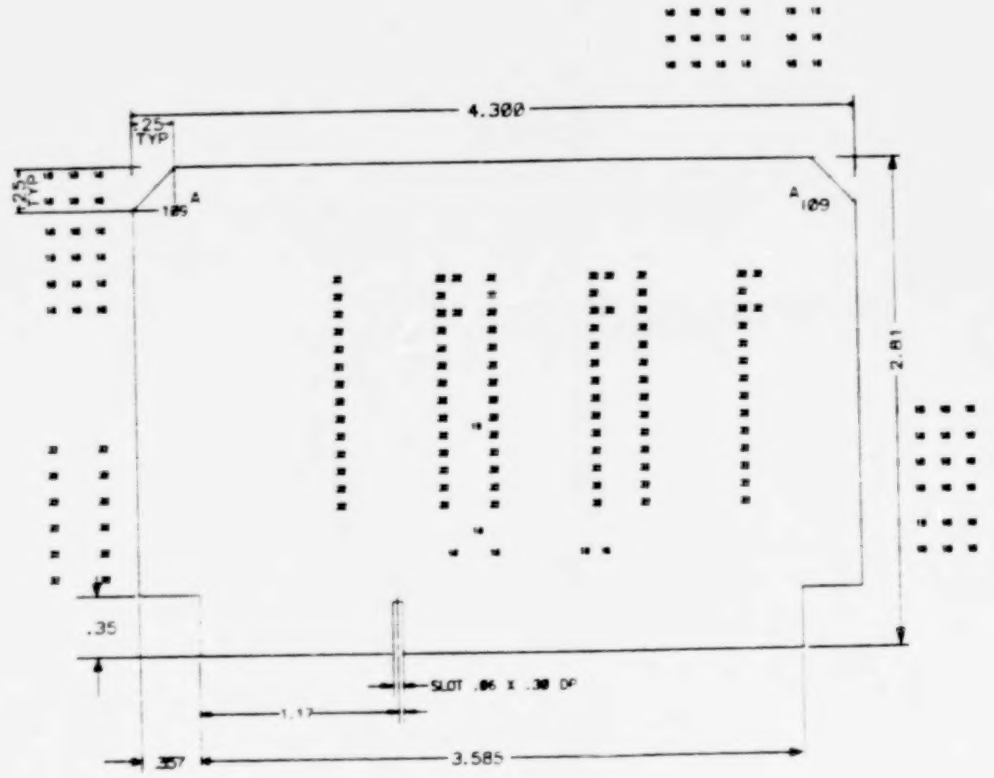
NOTES: UNLESS OTHERWISE SPECIFIED

NOTES:

1. HOLE SIZES ARE AFTER PLATING UNLESS OTHERWISE SPECIFIED
2. HOLE DIAMETER TOLERANCES:
   LESS THAN .100 +.002 -.002
   GREATER THAN .099 +.005 -.005
3. GRID INCREMENT: .025 INCH AT 1=1
4. MATERIAL USED FOR DOUBLE SIDED PRINTED CIRCUIT BOARDS SHALL BE CONFORM TO MIL-P-13949
5. CONSTRUCTION SHALL CONFORM TO MIL-STD-275 AND MIL-P-55110 WITH THE EXCEPTION THAT PAPER BASE COPPER-CLAD LAMINATES ARE NOT PERMITTED FOR PRINTED WIRING BOARDS PER FAA-G-2100, PARAGRAPH 3.5.5.15.3
6. BOARD TO BE FREE OF FRAYED AND SHARP EDGES
7. FINISH: SOLDER COAT OR TIN LEAD PLATE FOLLOWED BY REFLOW PER MIL-STD-275
8. TOLERANCES:
   2 PLACE DECIMAL: +.020 -.020
   3 PLACE DECIMAL: +.010 -.010
9. CONNECTOR AREA SHALL BE GOLD PLATED OVER LOW STRESS NICKEL ON BOTH SIDES PER MIL-STD-275
10. KEY SLOT SHALL BE LOCATED SYMMETRICALLY ABOUT CENTER LINE AS SHOWN
11. HOLES CODED A NOT PLATED THRU

REVISIONS

REV	DESCRIPTION	DATE	APPROVED
D	REV. AS PER E.O. E.O 0053	2-4-88	
E	REV AS PER E. O. 0313	9/10/88	
F	REV PER E.O. 0381	8/10/88	
G	REV PER E.O. 0410	11/28/88	
H	REL. TO PROD., REV PER E.O NO. 0447	1/9/89	



QTY REQD	FSCM NO.	DRAWING OR PART NUMBER	NOMENCLATURE OR DESCRIPTION	SPECIFICATION / MANUFACTURER	REFERENCE DESIGNATOR	ITEM NO.

PARTS LIST

NEXT ASSY	USED ON
000790	

APPLICATION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMAL DIMENSIONS
HOLE DIAMETER
FRACTIONS

MATERIAL
.063 FR4 1/2 oz/ft²

CONTRACT NO.
DTFA01-87-C-00006

DRAWN BY LDC DATE 2-4-88
CHECKED BY DATE
PROJECT ENGINEER DATE
QUALITY CONTROL DATE
RELEASED DATE

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

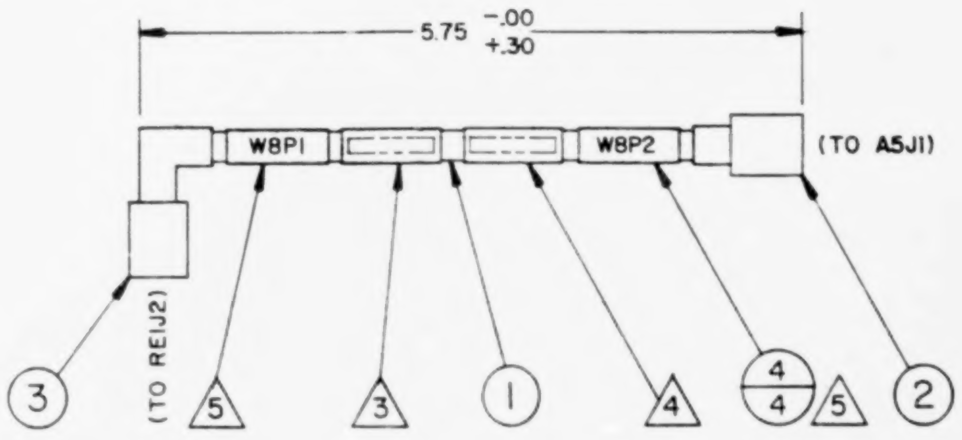
TITLE FABRICATION DWG, EEPROM MODULE, LORAN-C MONITOR

SIZE D
FSCM NO. 63812
DWG NO. 000792
SCALE
SHEET 1 OF 6

NOTES: UNLESS OTHERWISE SPECIFIED:

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
3. △3 MARK ITEM 4 WITH 63812-000795-1 AND REV.___ PRIOR TO ASSEMBLY
4. △4 MARK ITEM 4 WITH SERIAL NUMBER PRIOR TO ASSEMBLY
5. △5 MARK ITEM 4 AS SHOWN PRIOR TO ASSEMBLY. TRIM OFF EXCESS AFTER MARKING
6. SPLIT BALLOON: TOP FIGURE IS ITEM NUMBER, BOTTOM FIGURE IS QUANTITY
7. PARANTHETICAL INFORMATION IS FOR REFERENCE ONLY
8. △8 PREFIX ALL REFERENCE DESIGNATORS WITH W8

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	REVISED PER EO NO. 0237		
B	REVISED PER E.O. NO. 0362		
C	REL TO PROD, REV PER E.O. NO 0449	1/5/89	



QTY REQD	FSCM NO.	DRAWING OR PART NUMBER	NOMENCLATURE OR DESCRIPTION	SPECIFICATIONS / MANUFACTURER	REFERENCE DESIGNATOR	ITEM NO.
4	85480	DAT-42-292	DATAB MARKER	W. H. BRADY CO.		4
ALT	85480	HCPS 1.9-5008W	WIRE MARKER, HEAT SHRINK	W. H. BRADY CO.		4
1	81349	M39012/20-0002	CONNECTOR, BNC, R. ANGLE	MIL-C-39012/20	P1 △8	3
1	81349	M39012/16-0013	CONNECTOR, BNC, STRAIGHT	MIL-C-39012/16	P2 △8	2
6 IN	81349	RG-58 C/U	CABLE, COAX, RADIO FREQ			1

PARTS LIST

NEXT ASSY	USED ON
000700	

APPLICATION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES.
TOLERANCES ON
DECIMAL DIMENSIONS:
.XX = ±.020 .XXX = ±.010
HOLE DIAMETERS:
UP TO .500 ±.005
OVER .500 ±.008
ANGLES ±1° 00'
FRACTIONS ±1/32

MATERIAL

CONTRACT NO. DTFA01-87-C-00006
DRAWN BY RCD DATE 3-3-88
CHECKED BY DATE 3-9-88
PROJECT ENGINEER DATE 3/11/88
QUALITY CONTROL DATE
RELEASED DATE

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

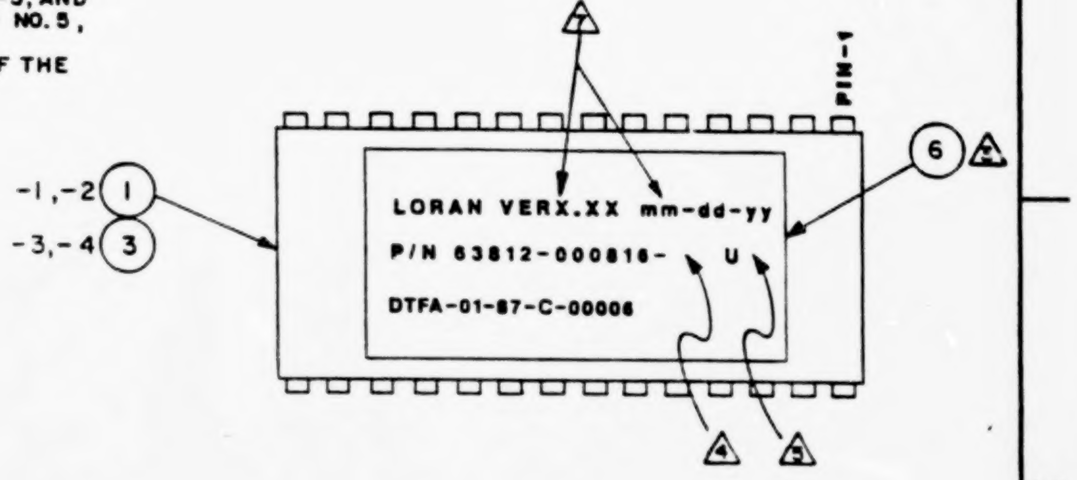
TITLE CABLE ASSEMBLY, CABLE DRIVER, LORAN-C MONITOR

SIZE C
FSCM NO. 63812
DWG NO. 000795
SCALE NONE
SHEET 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED:

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 2
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
3. MARK TEXT ON LABEL AS SHOWN, SUBSTITUTING CORRECT DASH NUMBER AND REFERENCE DESIGNATOR IN LOCATIONS SHOWN. TYPE TEXT BEFORE REMOVING LABEL FROM BACKING. ALL LABELS ON ONE SHEET OF BACKING MAY BE TYPED WITH IDENTICAL INFORMATION. PLACE LABEL ON I.C. AS ILLUSTRATED.
4. INSERT CORRECT DASH NUMBER IN THIS POSITION. CORRECT DASH NUMBER IS DETERMINED BY ADDRESS RANGE OF THE SOFTWARE WHICH IS CONTAINED IN THE EPROM. SEE TABLE BELOW.
5. INSERT THE REFERENCE DESIGNATOR CORRESPONDING TO LOCATION AT WHICH THE PROGRAMMED EPROM IS TO RESIDE. SEE TABLE BELOW.
6. ASSEMBLY NO. 000816, CONSISTING OF PART NUMBERS 000816-1, 000816-2, 000816-3, AND 000816-4, AND PROGRAMMED WITH THE VERSION OF SOFTWARE SPECIFIED IN ITEM NO. 5, AS SPECIFIED IN THE SOFTWARE PROGRAMMERS MANUAL FOR THE LORAN-C MONITOR, COMPRISES THE COMPLETE SYSTEM SOFTWARE REQUIRED FOR NORMAL OPERATION OF THE LORAN-C MONITOR DEVELOPED UNDER FAA CONTRACT NO. DTFA-01-87-C-00006
7. FOR X.XX, SUBSTITUTE THE CURRENT VERSION NUMBER AS SPECIFIED IN ITEM 5
FOR mm-dd-yy, SUBSTITUTE THE DATE OF THE CURRENT VERSION AS SPECIFIED IN ITEM 5

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	REL TO PROD, REV PER E.O. NO. 0450	1/5/89	KAO
B	REV PER E.O. NO. 0533	4/7/89	KAS
C	REV PER E.O. NO. 0534	4/11/89	[illegible]
D	REV PER E.O. NO. 1088	3/13/90	[illegible]



DASH NO (4)	REF. DESIG. (5)	LOCATION	ADDRESS RANGE
-1	U3	CPU PCB	0H TO 7FFFH
-2	U5	CPU PCB	8000H TO FFFFH
-3	U1	EPROM PCB	70000H TO 71FFFH
-4	U2	EPROM PCB	72000H TO 73FFFH

-4	-3	-2	-1	DRAWING OR PART NUMBER	NOMENCLATURE OR DESCRIPTION	SPECIFICATION / MANUFACTURER	REFERENCE DESIGNATOR	ITEM NO.
ALT	ALT	-	-	8200504yx	8Kx8 EPROM, 2764	DESC	U1, U2	3
-	-	ALT	ALT	8411101yx	32Kx8 EPROM, 27256	DESC	U3, U5	1
1	1	1	1	AVY S-816	LABEL, STICK-ON, .5"x1.0"	AVERY		6
REF	REF	REF	REF	VER1.11 11-14-89	SOFTWARE, LORAN-C			5
								4
1	1	-	-	8200503YA	8Kx8 EPROM, 2764	DESC	U1, U2	3
								2
-	-	1	1	M38510/22401BYA	32Kx8 EPROM, 27256	MIL-M-38510/224	U3, U5	1

QTY REQ'D

PARTS LIST

NEXT ASSY	USED ON
-3,-4 000820	LORAN-C
-1,-2 000720	LORAN-C

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMAL DIMENSIONS: .XX ±.030 .XXX ±.010 HOLE DIAMETERS: UP TO .500 +.005 OVER .500 +.008 ANGLES ±1° 00' FRACTIONS ±1/32

MATERIAL

CONTRACT NO. DTFA-01-87-C-00006
DRAWN BY dh DATE 12/1/88
CHECKED BY M. Webster DATE 12/9/88
PROJECT ENGINEER DATE
QUALITY CONTROL DATE
RELEASED DATE

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

TITLE
ASSY, EPROM, PROGRAMMED, LORAN-C MONITOR

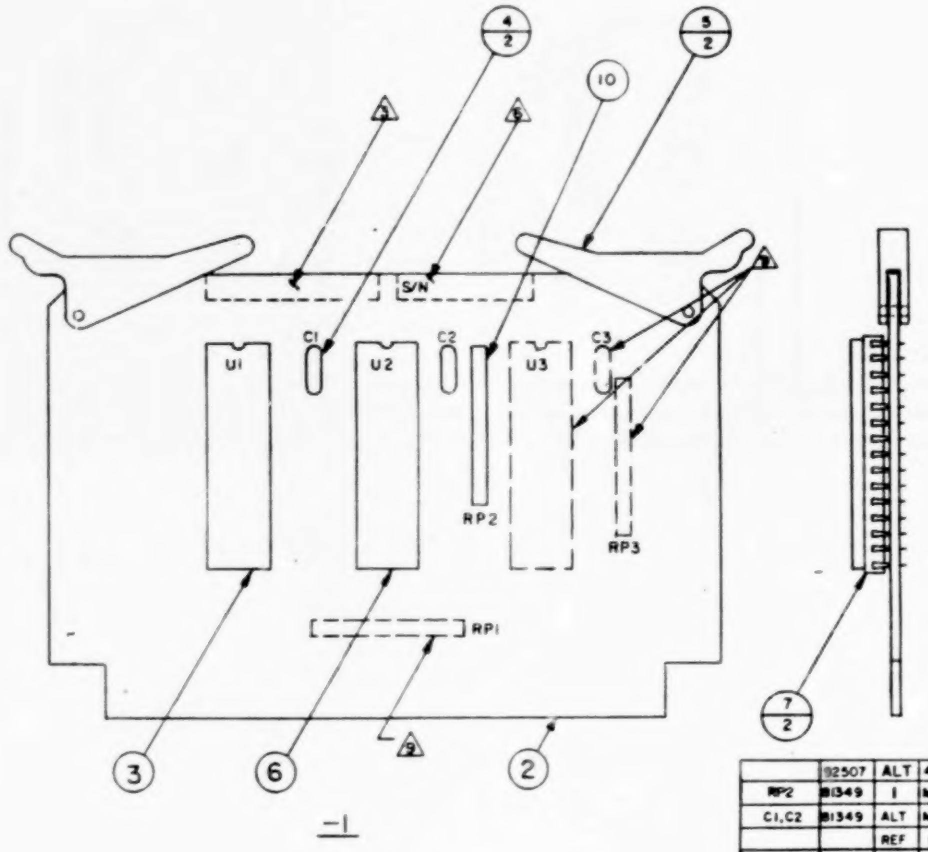
SIZE C
FSCM NO. 63812
DWG NO. 000816
SCALE NONE
SHEET 1 OF 1

NOTES:

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
3. MARK PART NUMBER 63812-000820-1 AND APPROPRIATE REV. LETTER
4. HIGHEST REF DES USED ARE: U2, C2
5. PREFIX ALL REF DES WITH A6
6. MARK SERIAL NUMBER IN LOCATION SHOWN
7. SPLIT BALLOON: TOP FIGURE IS ITEM NUMBER, BOTTOM FIGURE IS QUANTITY REQUIRED
8. SOLDER PER MIL-STD-454, REQUIREMENT 5 USING ITEM NO. 8
9. LOCATIONS U3,C3,RP1 AND RP3 FOR FUTURE EXPANSION, DO NOT INSTALL COMPONENTS IN THESE LOCATIONS

REVISIONS

LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REVISED PER EO NO. 0364		
B		RELEASE TO PRODUCTION, REV PER EO 0461	1/9/89	
C		REVISED PER E.O. NO 0485	2/16/89	
D		REV PER E.O. NO 0503	2/27/89	
E		REV PER E.O 0683	9/13/89	
F		REV PER E.O 0833	7/27/90	



REF DES	FSCM NO.	QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO.
	92507	ALT	4610X-101-821	RESISTOR, NETWORK	BOURNS		10
RP2	81349	1	M8340109X8200XC	RESISTOR NETWORK, 10 PIN SIP		MIL-R-83401	10
C1,C2	81349	ALT	M39014/01-1553	CAPACITOR, .1µf		M39014/ 1	4
		REF	117AT003	PROCEDURE, ACCEPTANCE TEST			9
	81349	AR	SN63BS	SOLDER		QQ-S-571	8
XU1,XU2	91506	2	828AG11D	SOCKET, IC, 28 POSITION	AUGAT		7
U2		1	000816-4	EPROM, PROGRAMMED ASSY			6
	60395	2	EJ-2001-W	EJECTOR, CIRCUIT CARD	ELECTRO-SPACE FAB. INC.		5
C1,C2	81349	2	M39014/01-1554	CAPACITOR, .1µf		M39014/ 1	4
U1		1	000816-3	EPROM, PROGRAMMED ASSY			3
		1	000822	PRINTED WIRING BOARD			2
		REF	000821	SCHEMATIC			1

PARTS LIST

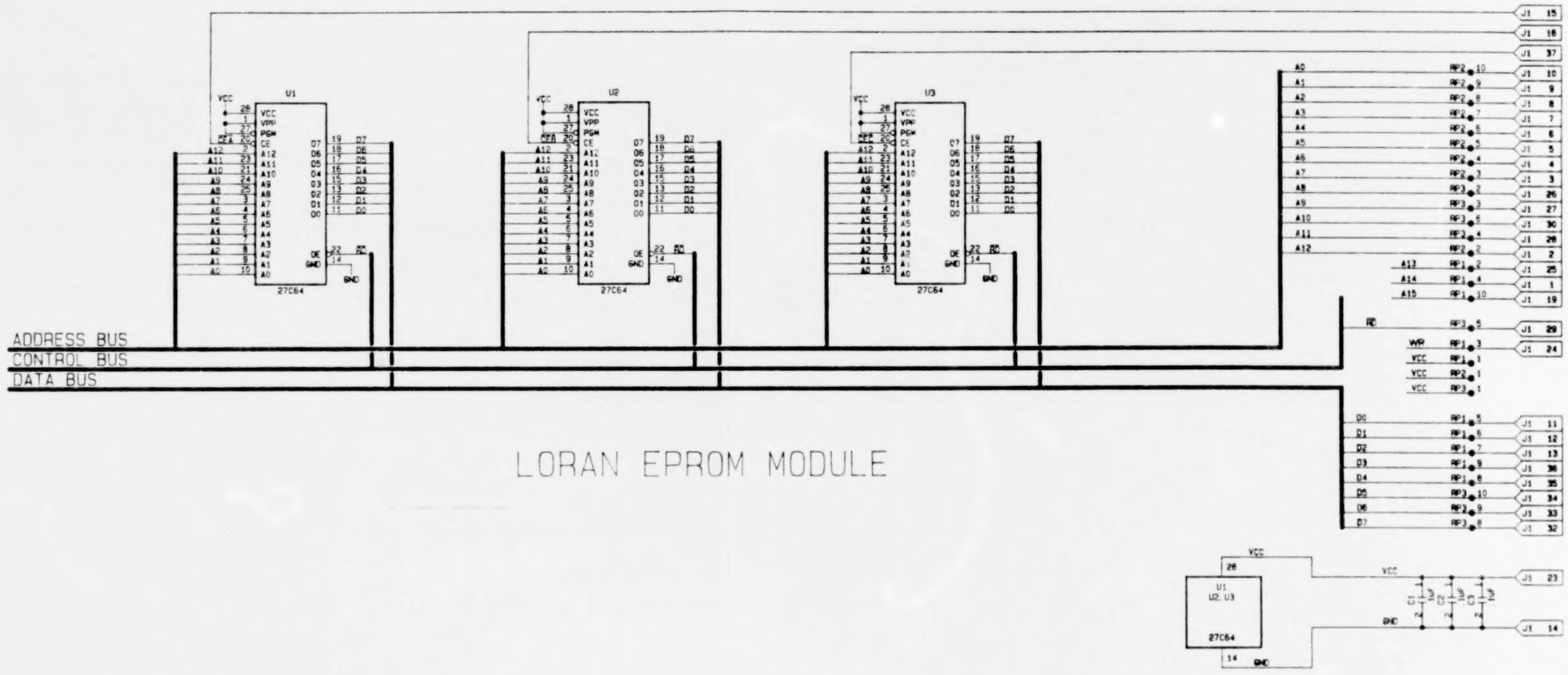
APPLICATION NEXT ASSY 000700	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: 2 PLACE DECIMALS ± .01 3 PLACE DECIMALS ± .005 FRACTIONS ± 1/64 ANGLES ± 0°30' MATERIAL	ORIGINAL DATE OF DRAWING 3-10-86 DRAWN MSW CHECKED APPROVED Kurt Schuh 3/10/87 APPROVED Paul D. Chamberlin 4/14/81 CONTRACT NO. DTFA01-87-C-00006	FRONTIER ENGINEERING INC. STILLWATER, OKLAHOMA 74075 **EPROM MODULE ASSY, LORAN-C MONITOR** 83812 D 000820 SCALE NONE SHEET 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED

NOTES:
1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ALL DESIGNATORS WITH: A6.
3. HIGHEST REFERENCE DESIGNATION USED: U3, C3.

REVISIONS

REV	DESCRIPTION	DATE	APPROVED
A	REV PER E.O. 0374	[illegible]	[illegible]
B	REL TO PROD, REV PER E.O. 0452	[illegible]	[illegible]
C	REVISED & REDRAWN PER E.O. 0881	[illegible]	[illegible]


U1
U2
U3
27C64
VCC
VPP
PGM
CE
OE
GND
A0–A12
D0–D7
RD
ADDRESS BUS
CONTROL BUS
DATA BUS
LORAN EPROM MODULE
J1 15
J1 18
J1 37
A0 RP2 10 J1 10
A1 RP2 9 J1 9
A2 RP2 8 J1 8
A3 RP2 7 J1 7
A4 RP2 6 J1 6
A5 RP2 5 J1 5
A6 RP2 4 J1 4
A7 RP2 3 J1 3
A8 RP3 2 J1 26
A9 RP3 3 J1 27
A10 RP3 6 J1 30
A11 RP3 4 J1 28
A12 RP2 2 J1 2
A13 RP1 2 J1 25
A14 RP1 4 J1 1
A15 RP1 10 J1 19
RD RP3 5 J1 29
WR RP1 3 J1 24
VCC RP1 1
VCC RP2 1
VCC RP3 1
D0 RP1 5 J1 11
D1 RP1 6 J1 12
D2 RP1 7 J1 13
D3 RP1 9 J1 36
D4 RP1 8 J1 35
D5 RP3 10 J1 34
D6 RP3 9 J1 33
D7 RP3 8 J1 32
U1
U2, U3
27C64
28
14
VCC
GND
C1 1uF
C2 1uF
C3 1uF
J1 23
J1 14

QTY REQD	FSCM NO.	DRAWING OR PART NUMBER	NOMENCLATURE OR DESCRIPTION	SPECIFICATION / MANUFACTURER	REFERENCE DESIGNATOR	ITEM NO.

PARTS LIST

NEXT ASSY	USED ON
000820	

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMAL DIMENSIONS: .XX = ±.030 .XXX = ±.010
HOLE DIAMETER: UP TO .500 +.004 OVER .500 +.008
ANGLES ±1° 00'
FRACTIONS ±1/32

MATERIAL

CONTRACT NO. DTFA01-87-C-00006

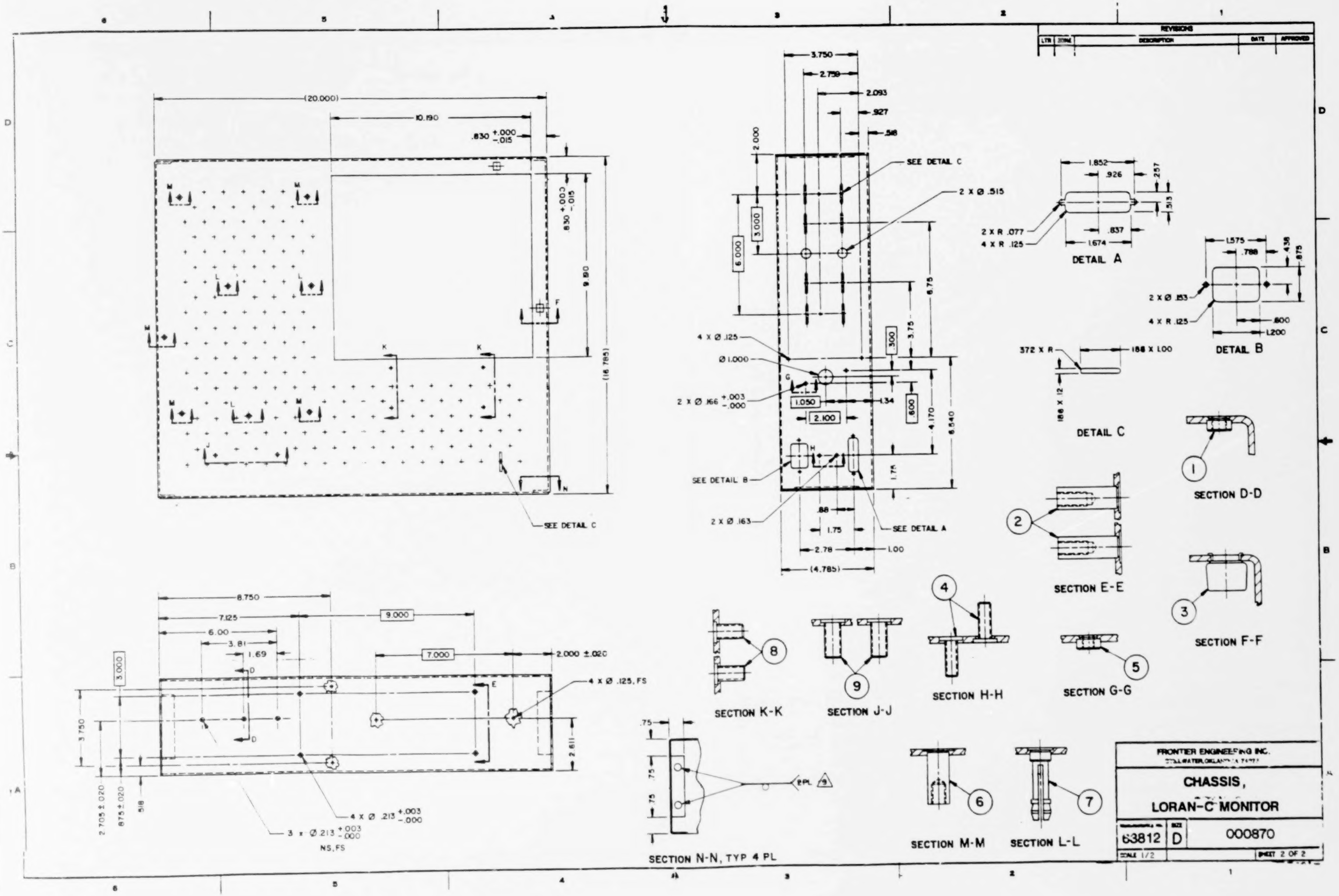
DRAWN BY L Casey [illegible] DATE [illegible]
CHECKED BY DATE [illegible]
PROJECT ENGINEER DATE [illegible]
QUALITY CONTROL DATE [illegible]
RELEASED HJS DATE [illegible]

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

TITLE
SCHEMATIC
EPROM MODULE
LORAN-C MONITOR

SIZE D FSCM NO. 63812 DWG NO. 000821
SCALE NTS SHEET 1 OF 1

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED



(20.000)
10.190
.830 +.000 −.015
9.190
(16.785)
SEE DETAIL C
M
L
K
J
N
F
3.750
2.759
2.093
.927
.518
2.000
3.000
6.000
SEE DETAIL C
2 X Ø .515
6.75
3.75
.300
4 X Ø .125
Ø 1.000
2 X Ø .166 +.003 −.000
1.050
2.100
1.34
.600
4.170
6.540
SEE DETAIL B
2 X Ø .163
1.75
.88
SEE DETAIL A
2.78
1.00
(4.785)
1.852
.926
.257
.513
2 X R .077
4 X R .125
.837
1.674
DETAIL A
1.575
.788
.438
.875
2 X Ø .153
4 X R .125
.800
1.200
DETAIL B
.372 X R
.188 X 1.00
.188 X 12
DETAIL C
SECTION D-D
SECTION E-E
SECTION F-F
SECTION G-G
SECTION H-H
SECTION J-J
SECTION K-K
SECTION L-L
SECTION M-M
SECTION N-N, TYP 4 PL
8.750
7.125
9.000
6.00
3.81
1.69
7.000
2.000 ±.020
3.000
4 X Ø .125, FS
3.750
2.611
2.705 ±.020
.875 ±.020
.518
4 X Ø .213 +.003 −.000
3 X Ø .213 +.003 −.000
NS, FS
.75
2PL
9
1
2
3
4
5
6
7
8
9

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA

CHASSIS,
LORAN-C MONITOR

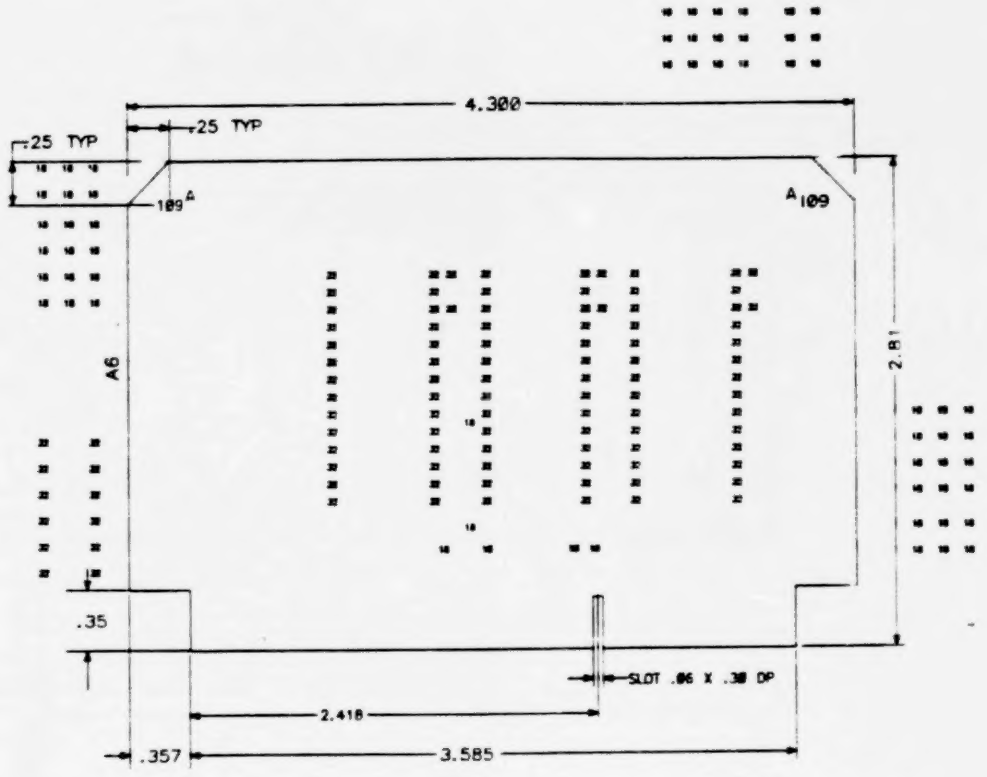
63812	D	000870
SCALE 1/2		SHEET 2 OF 2

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
B	REV PER E.O. 0310	9/16/88	RAS
C	REV PER E.O. 0380	11/30/88	KRS
D	REL. TO PROD. REV PER E.O. NO. 0454	1/5/89	KRS

NOTES: UNLESS OTHERWISE SPECIFIED

NOTES:

1. HOLE SIZES ARE AFTER PLATING UNLESS OTHERWISE SPECIFIED
2. HOLE DIAMETER TOLERANCES:
   LESS THAN .100 +.002 -.002
   GREATER THAN .099 +.005 -.005
3. GRID INCREMENT: .025 INCH AT 1=1
4. MATERIAL USED FOR DOUBLE SIDED PRINTED CIRCUIT BOARDS SHALL BE CONFORM TO MIL-P-13949
5. CONSTRUCTION SHALL CONFORM TO MIL-STD-275 AND MIL-P-55110 WITH THE EXCEPTION THAT PAPER BASE COPPER-CLAD LAMINATES ARE NOT PERMITTED FOR PRINTED WIRING BOARDS PER FAA-G-2100, PARAGRAPH 3.5.5.15.3
6. BOARD TO BE FREE OF FRAYED AND SHARP EDGES
7. FINISH: SOLDER COAT OR TIN LEAD PLATE FOLLOWED BY REFLOW PER MIL-STD-275
8. TOLERANCES:
   2 PLACE DECIMAL: +.020 -.020
   3 PLACE DECIMAL: +.010 -.010
9. CONNECTOR AREA SHALL BE GOLD PLATED OVER LOW STRESS NICKEL ON BOTH SIDES PER MIL-STD-275
10. KEY SLOT SHALL BE LOCATED SYMMETRICALLY ABOUT CENTER LINE AS SHOWN
11. HOLES CODED A ARE NOT PLATED THRU



QTY REQD	FSCM NO.	DRAWING OR PART NUMBER	NOMENCLATURE OR DESCRIPTION	SPECIFICATION / MANUFACTURER	REFERENCE DESIGNATOR	ITEM NO.

PARTS LIST

NEXT ASSY	USED ON
000820	

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMAL DIMENSIONS:
.XX = ±.020 .XXX = ±.010
HOLE DIAMETER:
UP TO .000 ±.004
OVER .000 ±.000
ANGLES ±1° 00'
FRACTIONS ±1/32

MATERIAL
.063 FR4 1/2 oz/ft²

CONTRACT NO.
DTFA01-87-C-00006

		DATE
DRAWN BY	AM	3/11/88
CHECKED BY	LF	3/14/88
PROJECT ENGINEER	RAS	3/14/88
QUALITY CONTROL		3/14/88
RELEASED		

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

TITLE
FABRICATION DWG,
EPROM MODULE,
LORAN-C MONITOR

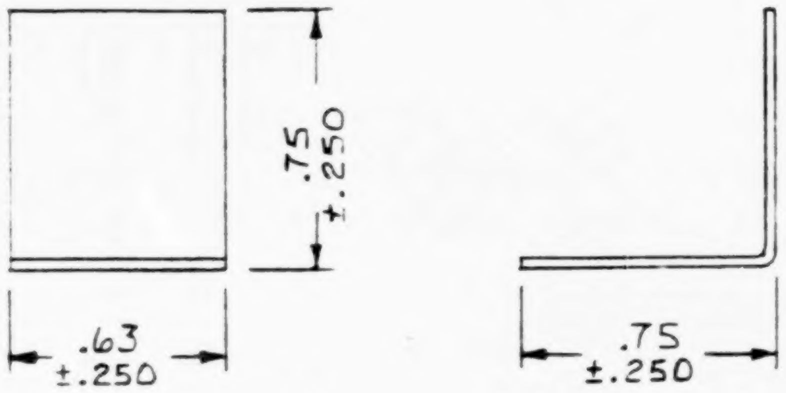
SIZE	FSCM NO.	DWG NO.
D	63812	000822

SCALE

SHEET 1 OF 6

NOTES:
1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. WORKMANSHIP PER MIL-STD-454 REQUIREMENT 9
3. MATERIAL: .080 THK ALUMINUM, 5052-H32 PER QQ-A-250/8
4. MARK PART NUMBER 63812-000875-1 REV_ BY BAGGING AND/OR TAGGING
5. ALL BEND RADII .06

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVAL
A	REV PER E.D.# 0343	[illegible]	
B	RELEASE TO PRODUCTION, REV PER ED 0455	1/5/89	KAS



		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON 2 PLACE DECIMALS ± .04 3 PLACE DECIMALS ± .010 FRACTIONS ± 1/16 ANGLES ± 0°30'	ORIGINAL DATE OF DRAWING 2-16-88 DRAFTSMAN MW CHECKER YF GR LEADER SUBMITTED KAS 2/16/88 APPROVED KAS 2/22/88 APPROVED Paul A. Chanell 2/22/88 CONTRACT NO DTFA01-87-C-00006
000760		MATERIAL SEE NOTE 3	
NEXT ASSY	CODE NO		
APPLICATION			

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

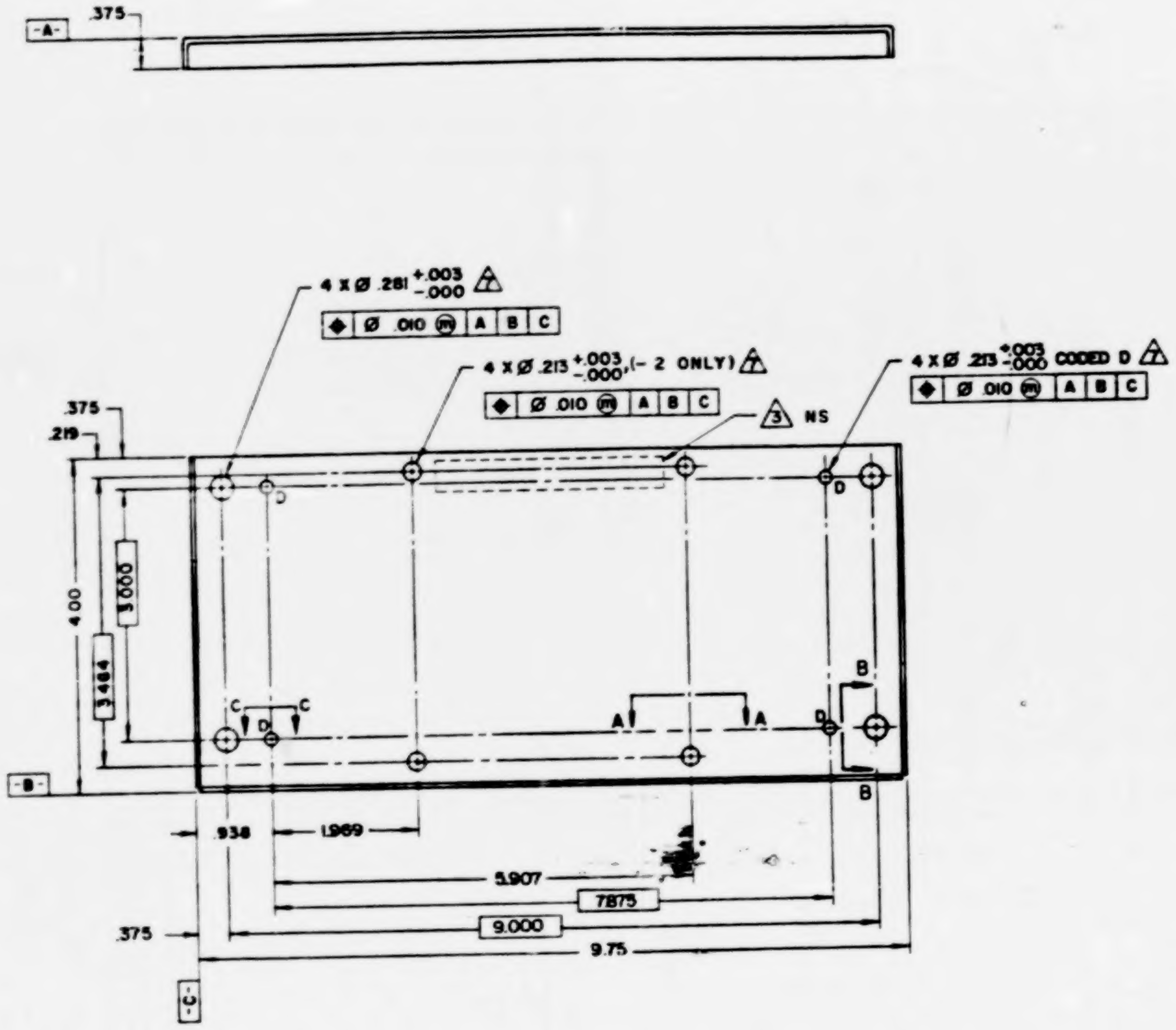
BRACKET, CHASSIS,
LORAN-C MONITOR

Manufacturing No.	SIZE	
63812	B	000875
SCALE 2/1		SHEET 1 OF 1

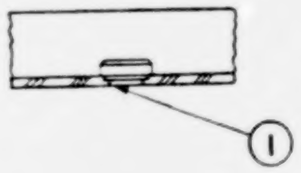
REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REVISED PER EO NO. 0020	11-12-87	KVF
B		REVISED PER E.O. NO. 0361		
C		RELEASE TO PRODUCTION, REV PER EO0453	1/5/89	

NOTES:

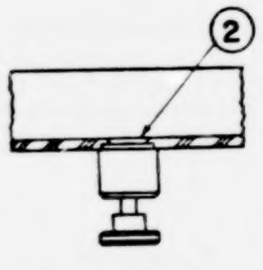
1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000 LEVEL 3
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
3. MARK PART NUMBER 63812-000860-1 REV__ IN APPROXIMATE LOCATION SHOWN WITH .12 HIGH CHARACTERS USING BLACK EPOXY INK PER FAA-G-2100, PARAGRAPH 3.9
4. CHEM FILM OR CLEAR ANODIZE PER FAA-G-2100, PARAGRAPH 3.7.6.2
5. PARANTHETICAL INFORMATION IS FOR REFERENCE ONLY
6. ALL BEND RADII .03
7. DO NOTE DEBURR
8. ALL BEND RELIEF .09R


-A-
.375
4 X Ø .281 +.003 -.000 7
◆ Ø .010 Ⓜ A B C
4 X Ø .213 +.003 -.000 (-2 ONLY) 7
◆ Ø .010 Ⓜ A B C
4 X Ø .213 +.003 -.000 CODED D 7
◆ Ø .010 Ⓜ A B C
3 NS
.375
.219
4.00
3.000
3.464
-B-
C C D D D D
A A
B B
.938
1.969
5.907
7.875
9.000
9.75
.375
-C-

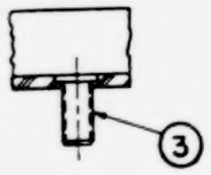
-1 SHOWN
-2 NOTED



SECTION A-A
SCALE 2/1



SECTION B-B
SCALE 2/1



SECTION C-C
SCALE 2/1

QTY REQD	FSCM NUMBER	QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO.
4	46384	4 -	SOS-632-24	STAND-OFF	PENN ENG		3
4	46384	4	PFC2-632-40	PANEL FASTENER ASSEMBLY	PENN ENG	CLASS 2A (MIL-S-7742)	2
4	46384	-	CLS-832-2	SELF-CLINCHING FASTENER	PENN ENG	MIL-N-45938/1	1
-2		-1	PARTS LIST				

APPLICATION
NEXT ASSY
000750

UNLESS OTHERWISE SPECIFIED

MATERIAL
.063 THK ALUMINUM
5052-H32 PER
QQ-A-250/8

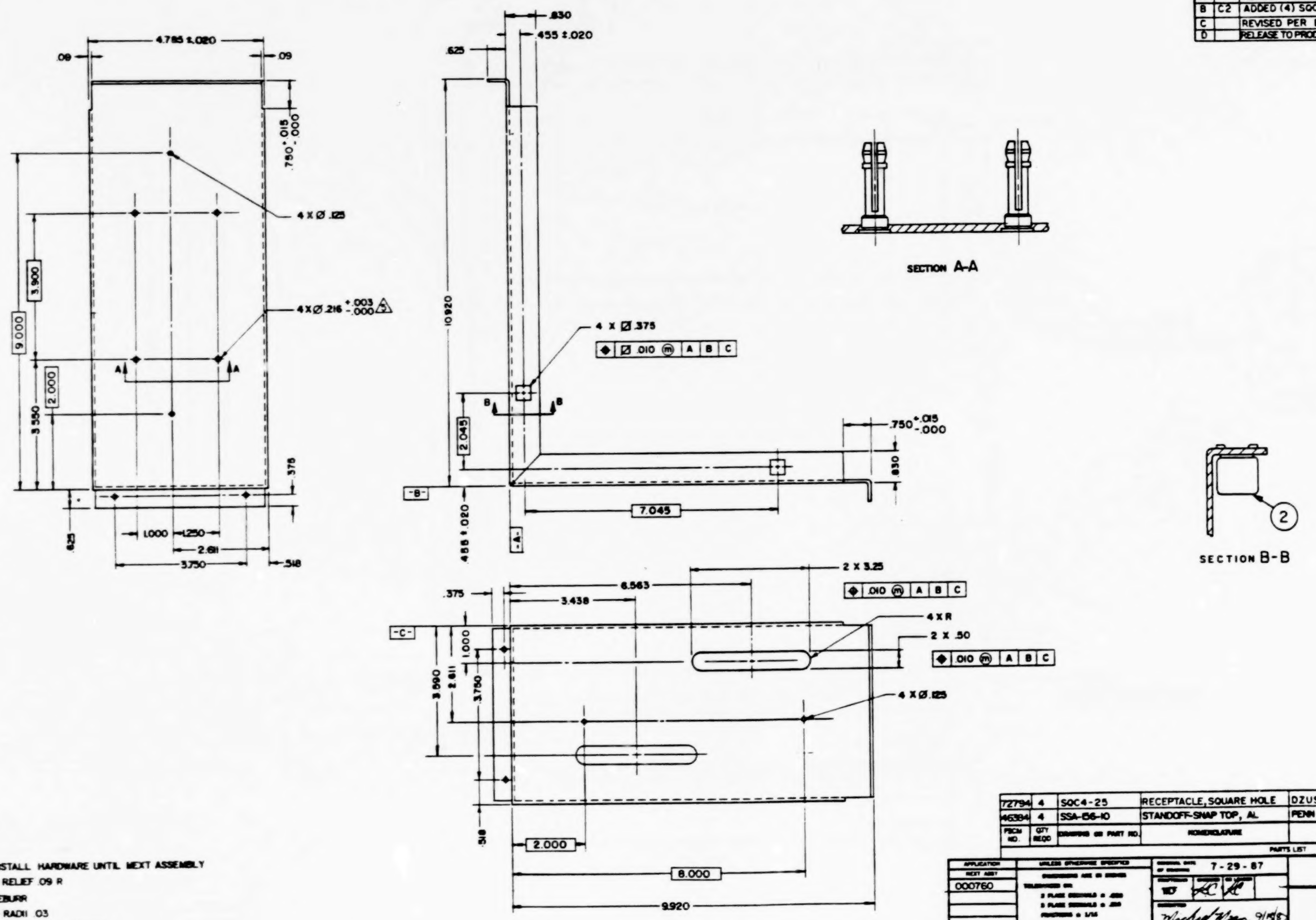
7-31-87
MF
M. Moran 9/16/87
9/16/88
Paul A Chenault 11/17/88
DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

CHASSIS, POWER SUPPLY,
LORAN-C MONITOR

63812
SIZE D
000860 -
SCALE 1/1
SHEET 1 OF 1

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REVISED PER E.O. NO. 0020	11-17-87	
B	C2	ADDED (4) SQC4-25 PER EO 0084	2-26-88	MLM
C		REVISED PER E.O. NO. 0359		
D		RELEASE TO PRODUCTION, REV PER EO 0456	1/8/81	



4.785 ±.020
.09
.09
.750 +.015 -.000
4 X Ø .125
4 X Ø .216 +.003 -.000 5
3.900
9.000
2.000
3.550
A
A
.375
.625
1.000
1.250
2.611
3.750
.518
.830
.455 ±.020
.625
10.920
4 X ▢ .375
◆ ▢ .010 Ⓜ A B C
B
B
2.045
-B-
.455 ±.020
-A-
7.045
.750 +.015 -.000
.830
SECTION A-A
2
SECTION B-B
2 X 3.25
◆ .010 Ⓜ A B C
6.563
.375
3.438
4 X R
2 X .50
◆ .010 Ⓜ A B C
-C-
1.000
2.611
3.750
3.590
4 X Ø .125
.518
2.000
8.000
9.920

7 DO NOT INSTALL HARDWARE UNTIL NEXT ASSEMBLY
6 ALL BEND RELIEF .09 R
5 DO NOT DEBURR
4 ALL BEND RADII .03
3 MARK PART NO. 63812-000880-1
REV.__ BY TAGGING
2 WORKMANSHIP PER MIL-STD-454, REQUIREMEN 9
1 INTERPRET DRAWING PER DOD-STD-100 AND
DOD-D-1000, LEVEL 3
NOTES

-1

72794	4	SQC4-25	RECEPTACLE, SQUARE HOLE	DZUS FASTENER CO. INC.		2
46384	4	SSA-156-10	STANDOFF-SNAP TOP, AL	PENN ENG		1
FSCM NO.	QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO

PARTS LIST

APPLICATION
NEXT ASSY
000760

MATERIAL
.08 THK. ALUMINUM
5052-H32 PER
QQ-A-250/8

7-29-87

Michael Mean 9/15/87

DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

BRACKET, INNER,
LORAN-C MONITOR

63812 | D | 000880

SCALE: NONE
SHEET 1 OF 1

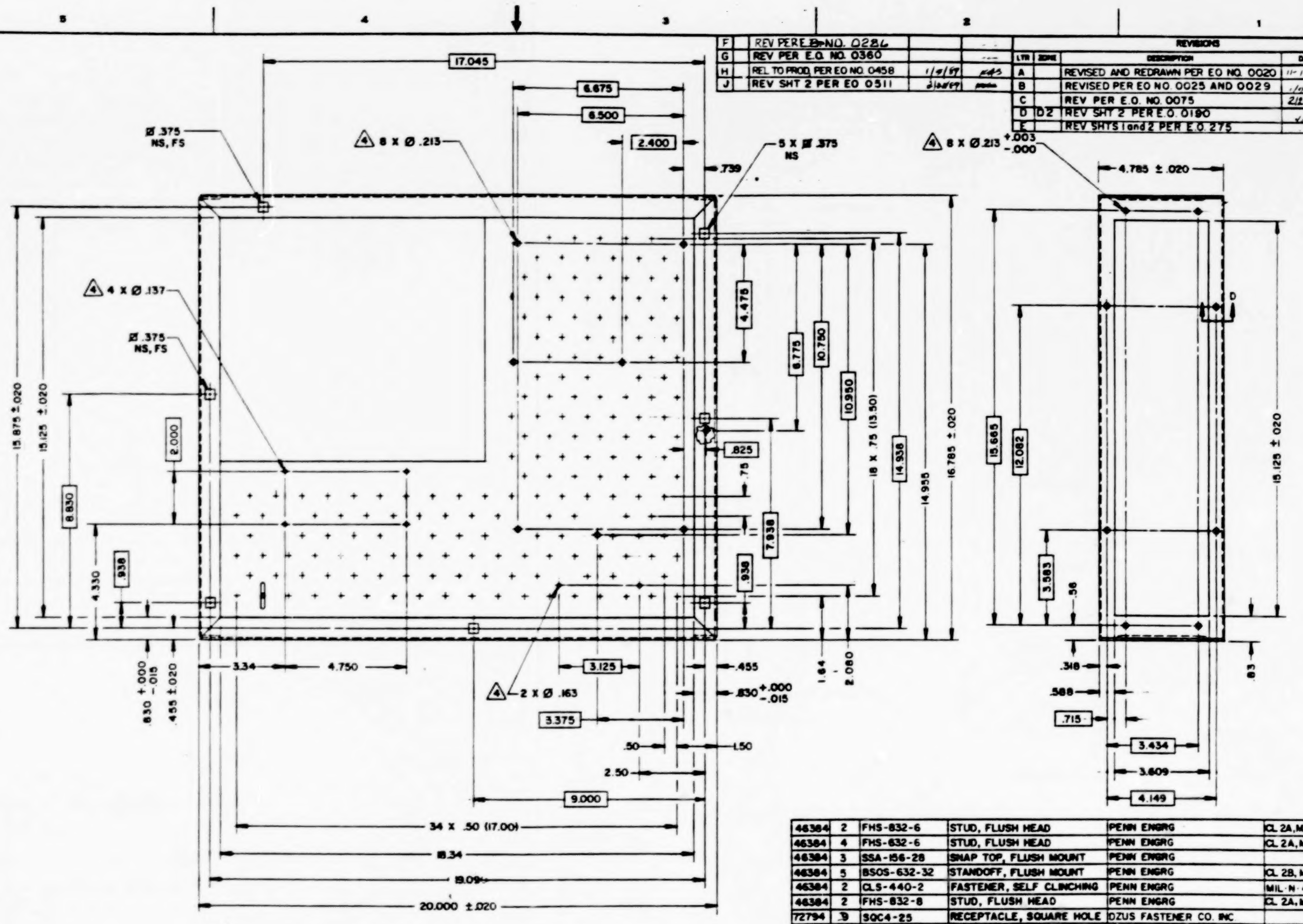
NOTES:

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
3. MARK PART NO. 63812-000870-1 AND CURRENT REVISION BY TAGGING
4. △ DO NOT DEBURR
5. ALL BEND RADII .06
6. PARANTHETICAL INFORMATION IS FOR REFERENCE ONLY
7. ALL BEND RELIEF .09R
8. DO NOT INSTALL HARDWARE UNTIL NEXT ASSEMBLY
9. △ SPOT WELD PER FAA-G-2300 AND RFA NUMBER 12057-5340-023

F		REV PER E.O. NO. 0286		
G		REV PER E.O. NO. 0360		
H		REL. TO PROD. PER EO NO. 0458	1/4/89	KAS
J		REV SHT 2 PER EO 0511	2/10/89	

REVISIONS

LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REVISED AND REDRAWN PER EO NO. 0020	11-17-87	
B		REVISED PER EO NO. 0025 AND 0029	1/11/88	
C		REV PER E.O. NO. 0075	2/24/88	MRM
D	D2	REV SHT 2 PER E.O. 0190	4/11/88	KAS
E		REV SHTS 1 and 2 PER E.O. 275		


17.045
6.675
6.500
2.400
.739
Ø .375 NS, FS
△4 8 X Ø .213
5 X Ø .375 NS
△4 8 X Ø .213 +.003 -.000
4.785 ± .020
△4 4 X Ø .137
Ø .375 NS, FS
15.875 ± .020
15.125 ± .020
2.000
8.830
4.330
.938
4.475
8.775
10.750
10.950
18 X .75 (13.50)
14.938
14.935
16.785 ± .020
.825
.75
7.938
.938
15.665
12.082
15.125 ± .020
3.583
.56
.83
.348
.588
.715
3.434
3.609
4.149
D
.830 +.000 -.015
.455 ± .020
3.34
4.750
3.125
.455
△4 2 X Ø .163
.830 +.000 -.015
3.375
1.64
2.080
.50
1.50
2.50
9.000
34 X .50 (17.00)
18.34
19.09
20.000 ± .020

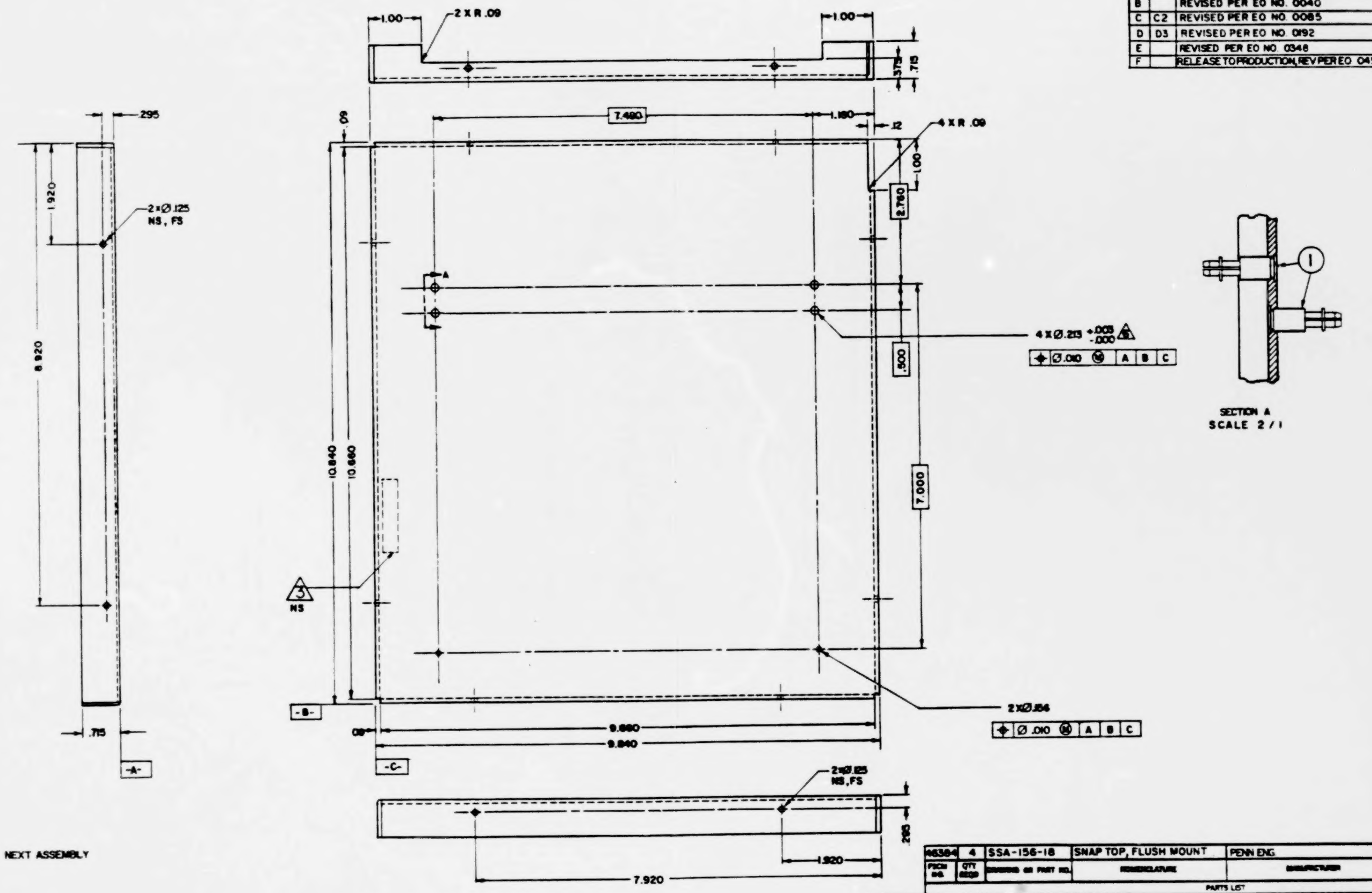
FSCM NO.	QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO
46384	2	FHS-832-6	STUD, FLUSH HEAD	PENN ENGRG	CL 2A, MIL-S-7742	9
46384	4	FHS-632-6	STUD, FLUSH HEAD	PENN ENGRG	CL 2A, MIL-S-7742	8
46384	3	SSA-156-28	SNAP TOP, FLUSH MOUNT	PENN ENGRG		7
46384	5	BSOS-632-32	STANDOFF, FLUSH MOUNT	PENN ENGRG	CL 2B, MIL-S-7742	6
46384	2	CLS-440-2	FASTENER, SELF CLINCHING	PENN ENGRG	MIL-N-45938/1	5
46384	2	FHS-832-8	STUD, FLUSH HEAD	PENN ENGRG	CL 2A, MIL-S-7742	4
72794	3	SQC4-25	RECEPTACLE, SQUARE HOLE	DZUS FASTENER CO. INC		3
46384	4	BSOS-632-26	STANDOFF, FLUSH MOUNT	PENN ENGRG	CL 2B, MIL-S-7742	2
46384	10	CLS-832-2	FASTENER, SELF CLINCHING	PENN ENGRG	MIL-N-45938/1	1

PARTS LIST

APPLICATION NEXT ASSY 000760		11-4-87	FRONTIER ENGINEERING INC. STILLWATER, OKLAHOMA 74075
		RCD	**CHASSIS, LORAN-C MONITOR**
	.08 THK ALUMINUM PLATE 5052-H32 PER QQ-A-250/8	Michael R.	63812 | D | 000870
		DTFA01-87-C-00006	SCALE 1/2 | SHEET 1 OF 2

-1

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REVISED PER EO NO. 0020	11-17-87	
B		REVISED PER EO NO. 0040		
C	C2	REVISED PER EO NO. 0085	2-26-88	
D	D3	REVISED PER EO NO. 0192		
E		REVISED PER EO NO. 0348		
F		RELEASE TO PRODUCTION, REV PER EO 0457	1/5/89	


1.00
2 X R .09
1.00
.375
.715
.295
.09
7.480
1.180
.12
4 X R .09
1.00
2.780
1.920
2×Ø.125
NS, FS
A
4 X Ø.213 +.005 -.000 6
⌖ Ø.010 Ⓜ A B C
.500
8.920
10.840
10.660
7.000
3
NS
2×Ø.164
⌖ Ø.010 Ⓜ A B C
-B-
.09
9.660
9.840
.715
-A-
-C-
2×Ø.125
NS, FS
.295
1.920
7.920
1
SECTION A
SCALE 2/1

8. DO NOT INSTALL HARDWARE UNTIL NEXT ASSEMBLY
7. ALL BEND RELIEF .09 R
6. DO NOT DEBURR
5. ALL BEND RADII .03
4. CHEM FILM OR CLEAR ANODIZE PER FAA-G-2100, PARAGRAPH 3.7.6.2
3. MARK PART NUMBER 63812-000890-1 REV.__ IN APPROXIMATE LOCATION SHOWN WITH .12 HIGH CHARACTERS USING BLACK EPOXY INK PER FAA-G-2100, PARAGRAPH 3.9
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3

NOTES:

-1

FSCM NO.	QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO.
46384	4	SSA-156-18	SNAP TOP, FLUSH MOUNT	PENN ENG.		1

PARTS LIST

APPLICATION
NEXT ASSY
000760

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PLACE DECIMALS ± .030
3 PLACE DECIMALS ± .010
FRACTIONS ± 1/16
ANGLES ± 0°30'

MATERIAL
.09 THK ALUMINUM
5052-H32
PER QQ-A-250/8

ORIGINAL DATE OF DRAWING 5-7-87
DRAWN J.W.
CHECKED KC
ISSUED LC
M. Moon 5/18/87
APPROVED
5/11/87
APPROVED
CONTRACT NO.
DTRS01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

BRACKET, SEPARATOR, LORAN-C MONITOR

FSCM NO.	SIZE	
63812	D	000890

SCALE: 1/1

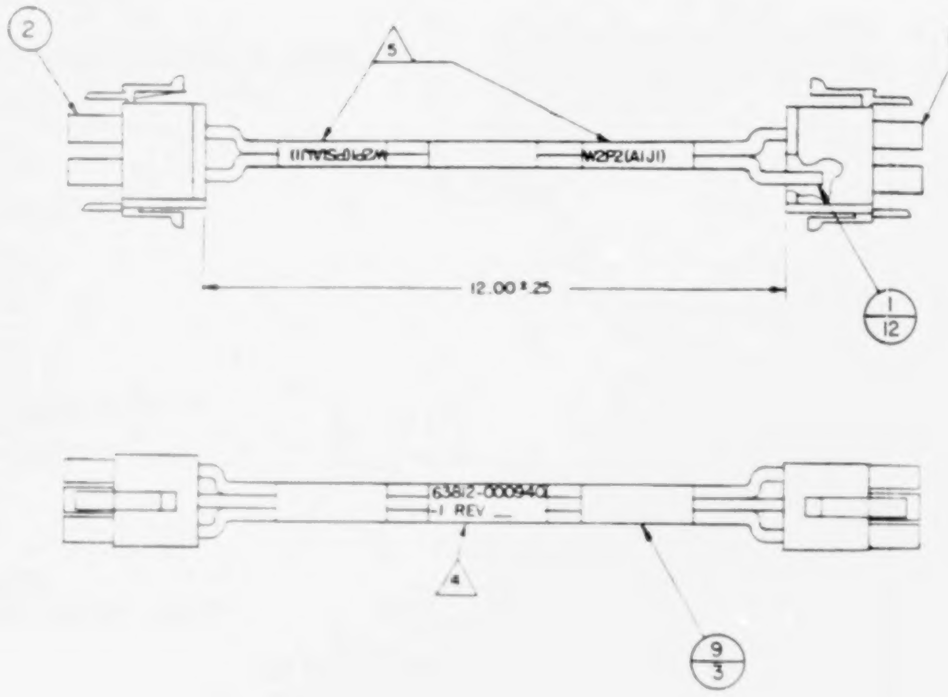
SHEET 1 OF 1

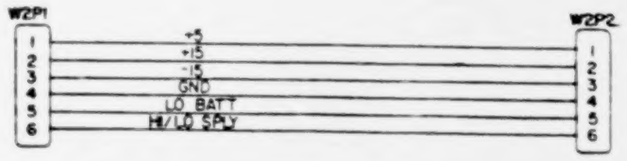
NOTES

1. CRIMP CONTACTS ONTO WIRES AND INSERT INTO HOUSING PER WIRE LIST
2. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
3. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
4. MARK PART NUMBER 63812-000940-1, APPROPRITE REV LEVEL AND SERIAL NO. AS SHOWN ON ITEM 9 BEFORE ASSEMBLY, BY TYPING
5. MARK REFERENCE DESIGNATORS AS SHOWN ON ITEM 9 BEFORE ASSEMBLY, BY TYPING
6.
7. SPLIT BALLOON: TOP FIGURE IS ITEM NUMBER, BOTTOM FIGURE IS QUANTITY REQUIRED

REVISIONS

LTR	ZONE	DESCRIPTION	DATE	APPROVED
A	D6	ADDED NOTE 8 PER E.O. 0081	2-26-88	MRM
B		REV PER E.O. NO. 0246		
C		REV PER E.O. NO. 0354		
D		RELEASE TO PRODUCTION, REV PER E.O. 0462	1/5/89	





-1

WIRE LIST

WIRE NO	ITEM NO	LENGTH	COLOR	FROM	TO	GAUGE
1	3	12.5 IN.	RED	W2P1P1	W2P2P1	18
2	4		ORG	W2P1P2	W2P2P2	18
3	5		WHT	W2P1P3	W2P2P3	18
4	6		BLK	W2P1P4	W2P2P4	18
5	7		GRN	W2P1P5	W2P2P5	18
6	8		YLW	W2P1P6	W2P2P6	18

PARTS LIST

FSCM NO	QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO.
85480	3	DAT-42-292	MARKER, DATAB	W.H. BRADY CO		9
96906	12.5	M16878/1BHB444	WIRE, STRANDED, 18 GA, YLW		M16878/1B	8
96906	12.5	M16878/1BHB555	WIRE, STRANDED, 18 GA, GRN		M16878/1B	7
96906	12.5	M16878/1BHB000	WIRE, STRANDED, 18 GA, BLK		M16878/1B	6
96906	12.5	M16878/1BHB999	WIRE, STRANDED, 18 GA, WHT		M16878/1B	5
96906	12.5	M16878/1BHB333	WIRE, STRANDED, 18 GA, ORG		M16878/1B	4
96906	12.5	M16878/1BHB222	WIRE, STRANDED, 18 GA, RED		M16878/1B	3
04618	2	1-480704-0	HOUSING	AMP		2
04618	12	350550-2	CONTACTS	AMP		1

APPLICATION
NEXT ASSY
000700

UNLESS OTHERWISE SPECIFIED

10-19-87

AW

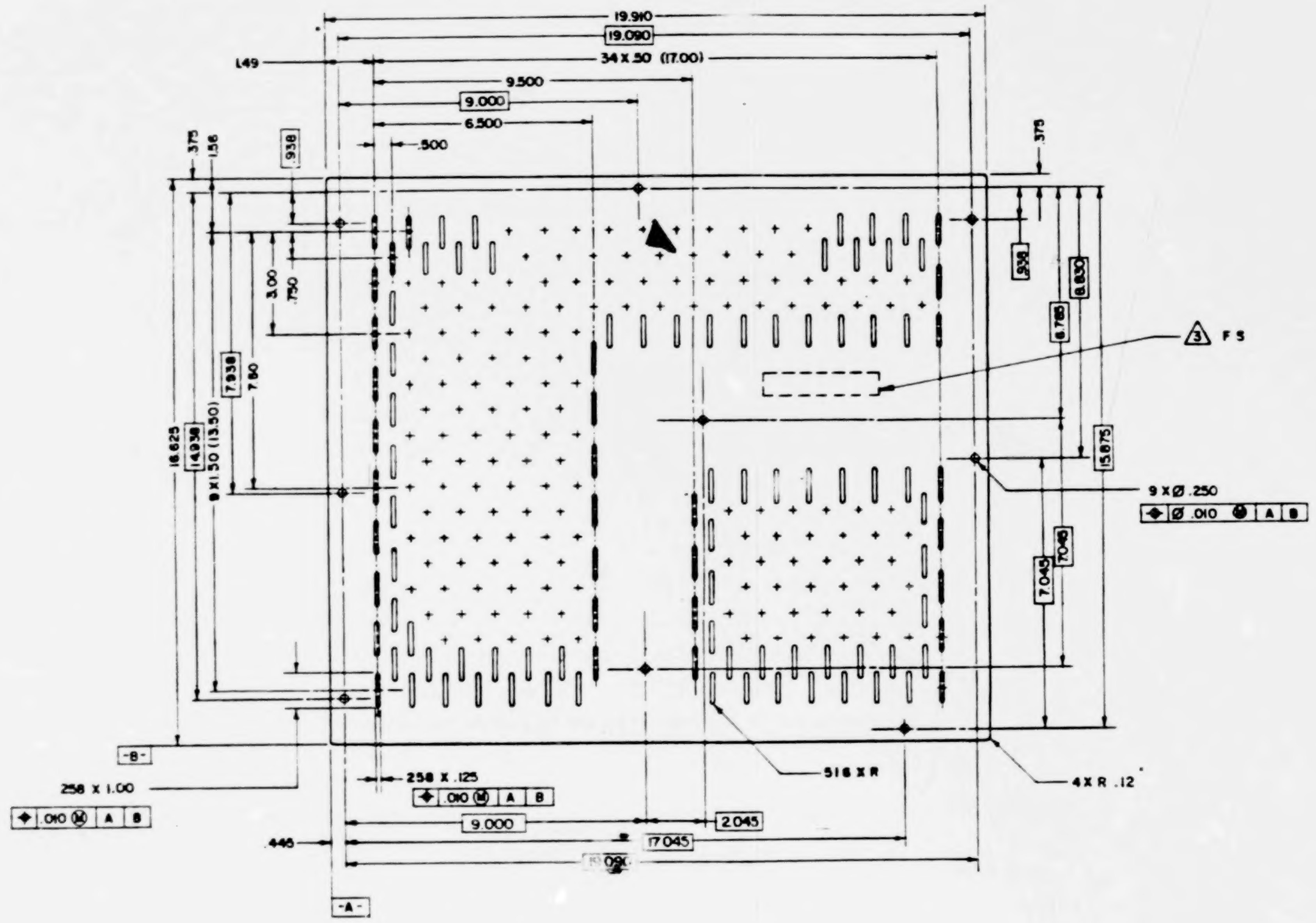
DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

CABLE ASSY, CPU POWER, LORAN-C MONITOR

	SIZE	
63812	D	000940
SCALE NONE		SHEET 1 OF 1

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REVISED PER E.O. NO. 0020	11-17-87	
B		REVISED PER E.O. NO. 0026		
C		REVISED PER E.O. NO. 0350		
D		REL TO PROD, REV PER E.O. NO. 0459	1/5/89	KAB


19.910
19.090
34 X .50 (17.00)
1.49
9.500
9.000
6.500
.500
.375
1.56
.938
.375
.938
6.830
6.785
15.875
3 F S
9 X Ø .250
Ø .010 M A B
3.00
.750
7.938
7.50
16.625
14.938
9 X 1.50 (13.50)
7.045
7.045
516 X R
4 X R .12
-B-
258 X .125
.010 M A B
258 X 1.00
.010 M A B
9.000
2.045
17.045
.446
19.090
-A-

-1

5 PARANTHETICAL INFORMATION IS FOR REFERENCE ONLY

4 CHEM FILM OR CLEAR ANODIZE PER FAA-G-2100, PARAGRAPH 3 7.6.2

3 MARK PART NUMBER 63812-000900-1 REV___ IN APPROXIMATE LOCATION SHOWN WITH .12 HIGH CHARACTERS USING BLACK EPOXY INK PER FAA-G-2100

2 WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9

1 INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000 LEVEL 3

NOTES

FSCM NO	QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO
PARTS LIST						

APPLICATION
NEXT ASSY
000700

UNLESS OTHERWISE SPECIFIED

MATERIAL
.063 THK ALUMINUM
5052-H32 PER
QQ-A-250/8

5-7-87
JW
KC
KC
M. Moon 9/15/87
Paul D. Chenault 9/17/87
CONTRACT NO.
DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74074

PANEL, TOP,
LORAN-C MONITOR

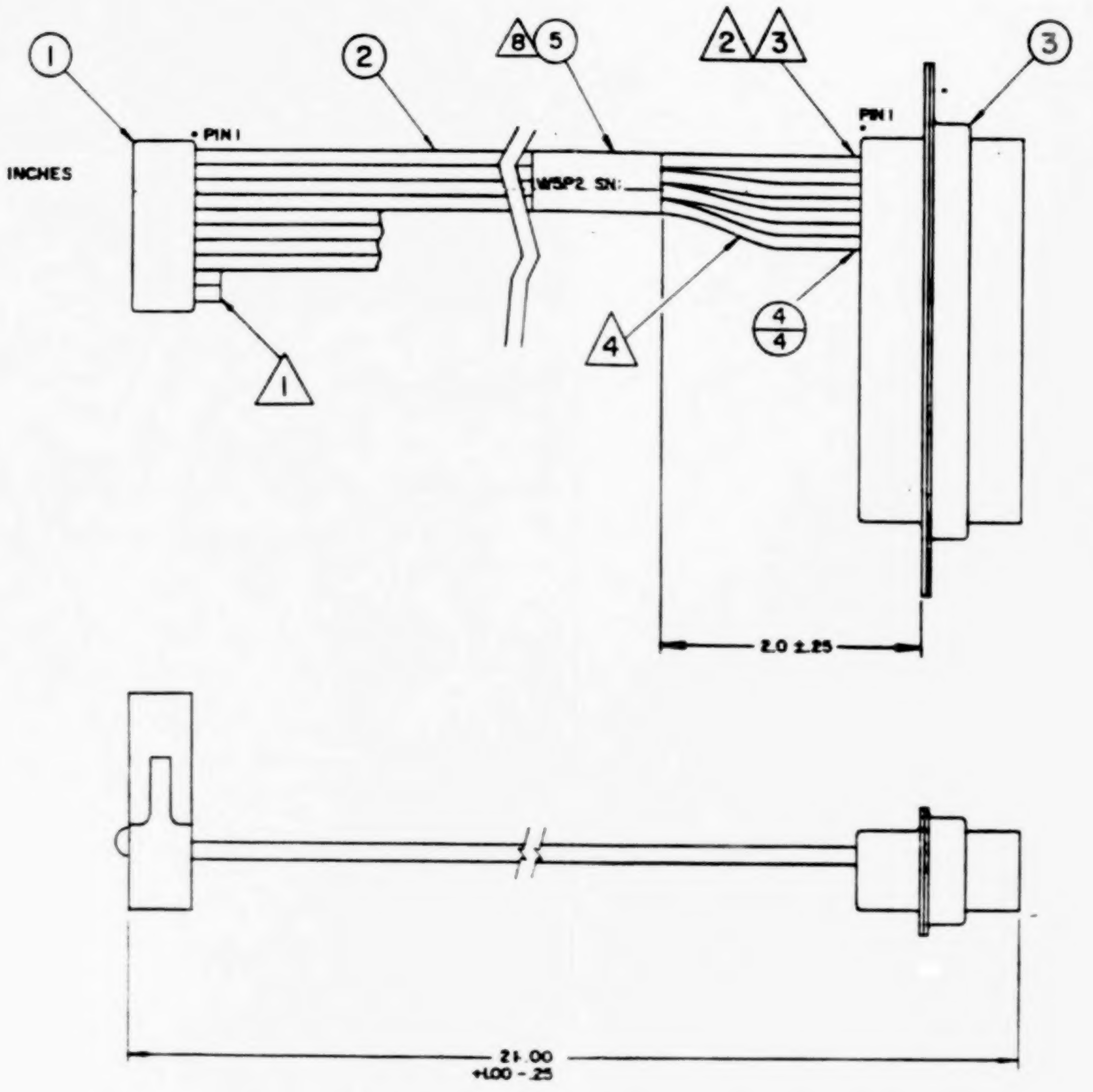
	SIZE	
63812	D	000900
SCALE 1/2		SHEET 1 OF 1

NOTES:

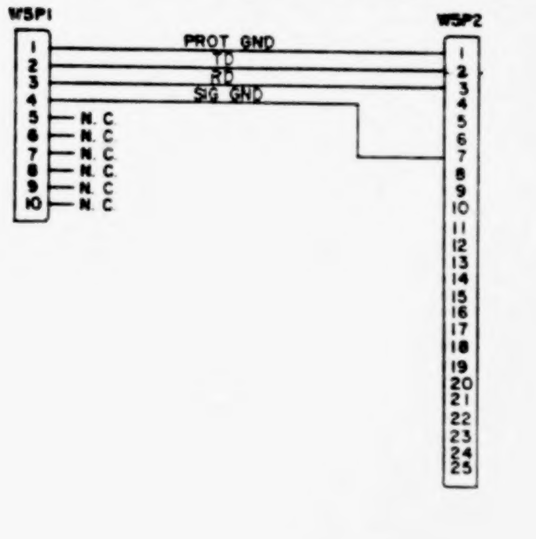
1. AFTER TERMINATION, TRIM CONDUCTORS 9 AND 10 TO 1/16 INCH, 5 THRU 8 TO 2 INCHES
2. INSERTION/EXTRACTION TOOL IS P/N 91067-3
3. HAND CRIMPING TOOL IS P/N 90312-1
4. STRIP, CRIMP, AND INSERT SUCH THAT:
   - a) CONDUCTORS ARE NOT DAMAGED OR EXPOSED BY EXCESSIVE STRIPPING
   - b) CONDUCTORS CAN BE SEEN ON THE SOCKET SIDE OF THE WIRE BARREL
   - c) CRIMPED JOINT WILL WITHSTAND PULL TESTING
   - d) BUSHING IS NOT DAMAGED DURING INSERTION
5. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
6. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
7. MARK PART NO. 63812-00960-1 AND APPROPRIATE REV LEVEL AND REF. DES. ON ITEM 3 AS SHOWN PRIOR TO ASSEMBLY, BY TYPING
8. MARK REFERENCE DESIGNATOR AND SERIAL NO. ON ITEM 3 AS SHOWN PRIOR TO ASSEMBLY, BY TYPING
9.

10. PARANTHETICAL INFORMATION IS FOR REFERENCE ONLY
11. SPLIT BALLOON: TOP FIGURE IS ITEM NO., BOTTOM FIGURE IS QUANTITY REQUIRED

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
A	C6	CHG'D NOTE 8 PER E.O. 0048	1-29-88	
B		REV PER E.O. NO. 0054	2-24-88	MRM
C		REV PER E.O. NO. 0245 & 0104	3/13/88	KMS
D		REV PER EO NO. 0347		
E		REV PER EO NO. 0352		—
F		REV PER E.O. 0397	11/7/88	KMS
G		REV PER E.O. 0413	12/14/88	KMS
H		RELEASE TO PRODUCTION, REV PER EO 0464	1/5/89	KAP



1
2
8
5
2
3
3
PIN 1
PIN 1
W5P2 SN:
1
4
4/4
2.0 ± .25
21.00
+1.00 -.25



W5P1
W5P2
PROT GND
TD
RD
SIG GND
1
2
3
4
5 N.C
6 N.C
7 N.C
8 N.C
9 N.C
10 N.C
1
2
3
4
5
6
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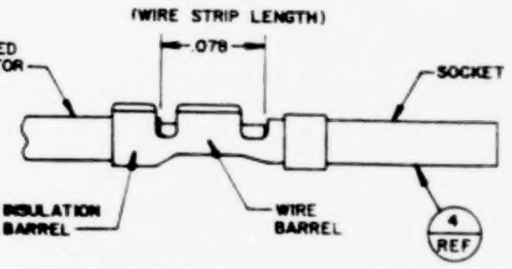
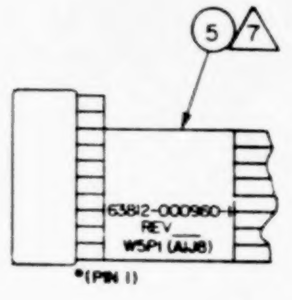
25



(WIRE STRIP LENGTH)
.078
INSULATED CONDUCTOR
SOCKET
INSULATION BARREL
WIRE BARREL
4
REF

WIRE SOCKET CONNECTION DETAIL
SCALE: NONE



5
7
63812-000960-1
REV.
W5P1 (A1J8)
*(PIN 1)

-1

FSCM NO.	QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO.
85480	2	DAT-42-292	MARKER, DATAB	(W.H. BRADY CO.)		5
00779	4	66505-8	CONTACT SIZE 20 DF SOCKET	AMP		4
96906	1	M24308/2-283	25 POS D RECEPTACLE CONNECTOR		M24308/2	3
.3812	25"	171-10	28 AWG STRANDED FLAT CABLE	(T AND B ANSLEY)		2
96906	1	M83503/7-01	10 POS RECEPTACLE CONNECTOR		M83503/7	1

PARTS LIST

APPLICATION
NEXT ASSY
000700

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:

MATERIAL

8-6-87

MCF

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

CABLE ASSY, FCPU, LORAN-C MONITOR

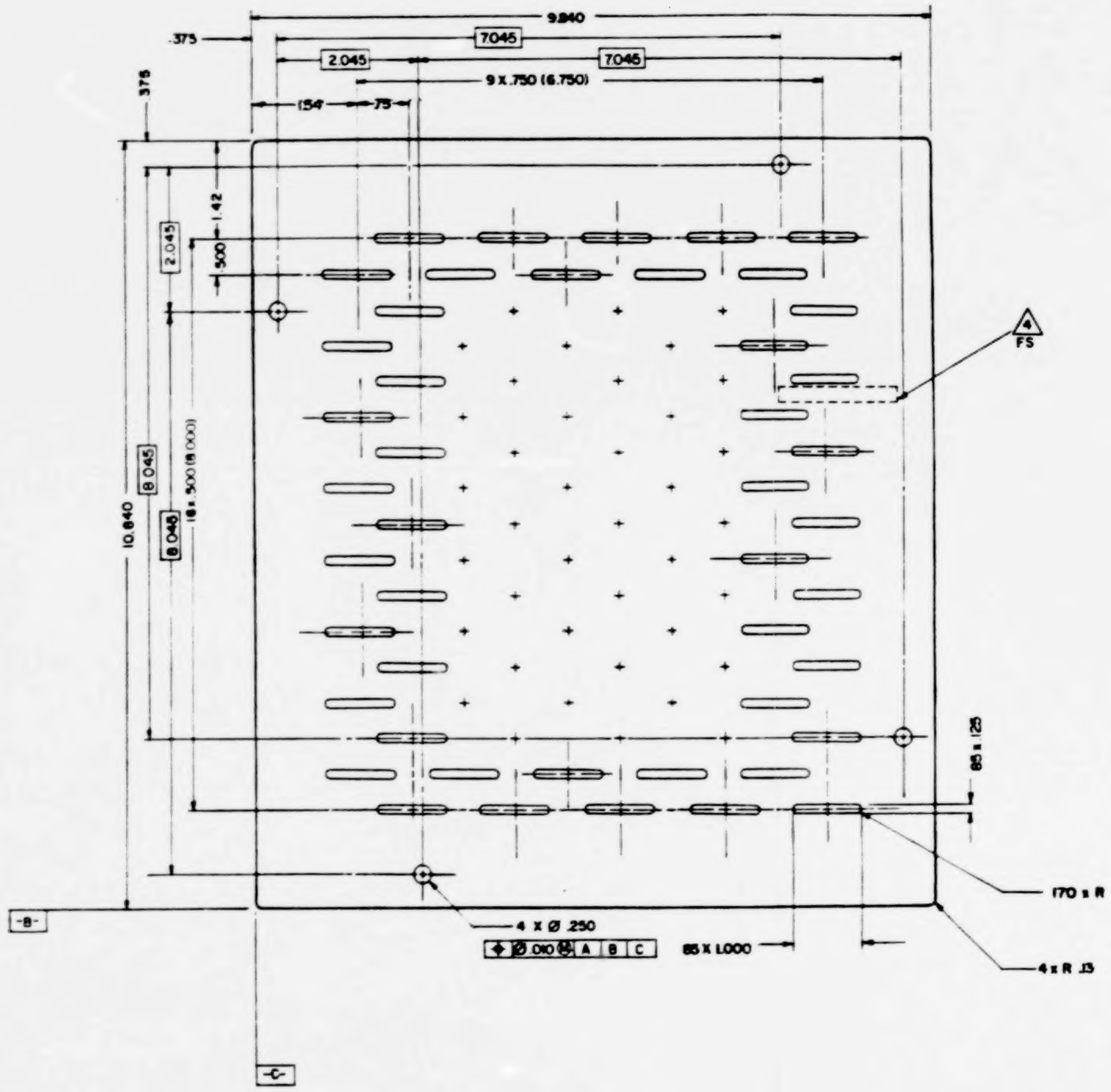
63812 | SIZE D | 000960

CONTRACT NO. DTFA01-87-C-00006

SCALE: NONE

SHEET 1 OF 1

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REVISED PER E.O. NO. 0020	11-17-87	
B		REVISED PER E.O. NO. 0349		
C		RELEASE TO PRODUCTION, REV PER E.O. 0460	1/5/89	



9.840
.375
7.045
2.045
7.045
9 X .750 (6.750)
.154
.75
.375
1.42
.500
2.045
8.045
8.045
16 x .500 (8.000)
10.840
4
FS
85 X .125
.170 x R
-B-
4 X Ø .250
⌖ Ø .010 Ⓜ A B C
85 X 1.000
4 x R .13
-C-

-1

NOTES

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
3. CHEM FILM OR CLEAR ANODIZE PER FAA-G-2100, PARAGRAPH 3.7.6.2
4. MARK PART NUMBER 63812-000915-1 REV.__IN APPROXIMATE LOCATION SHOWN WITH .12 HIGH CARACTERS USING BLACK EPOXY INK PER FAA-G-2100, PARAGRAPH 3.9
5. PARENTHETICAL INFORMATION IS FOR REFERENCE ONLY

PARTS LIST

APPLICATION
NEXT ASSY
000700

UNLESS OTHERWISE SPECIFIED

MATERIAL
.063 THK 5052-H32
ALUMINUM PER
QQ-A-250/8

6-11-87
J.W.
M. Moore 9/18/87
2/10/87

CONTRACT NO.
DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

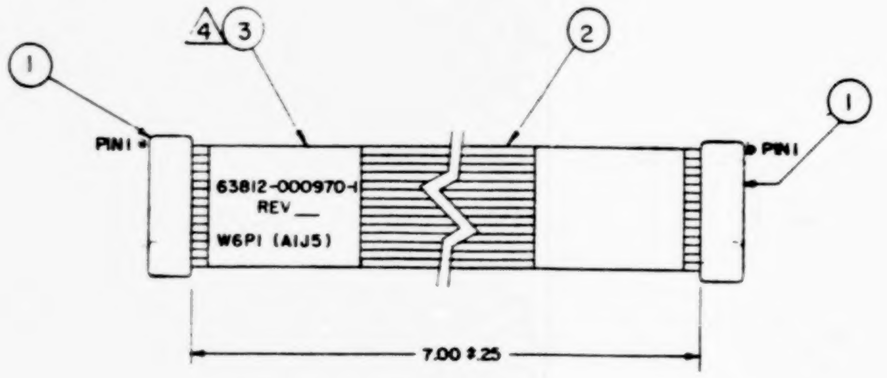
PANEL, ACCESS,
LORAN-C MONITOR

63812
SIZE D
000915

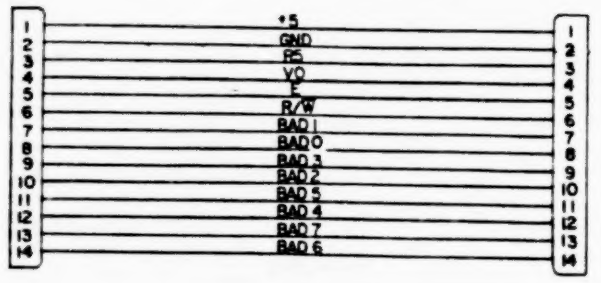
SCALE 1/1
SHEET 1 OF 1

NOTES:
1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
△3 MARK REF. DES. AND SERIAL NO. ON ITEM 3 AS SHOWN PRIOR TO ASSEMBLY, BY TYPING
△4 MARK PART NO: 63812-000970-1, APPROPIATE REV LEVEL AND REF. DES. ON ITEM 3 AS SHOWN PRIOR TO ASSEMBLY, BY TYPING

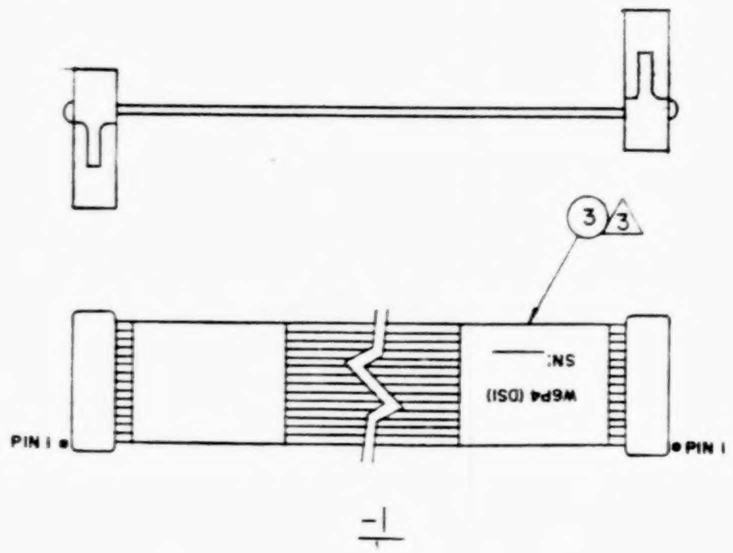
REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
A	D6	CHG'D NOTE △4 PER E.O. 0049	1-29-88	[illegible]
B		REV PER E.O. NO. 0065	2-22-88	[illegible]
C		REV PER E.O. NO. 0242	[illegible]	[illegible]
D		REV PER E.O. NO. 0355		
E		RELEASE TO PRODUCTION, REV PER E.O. 0466	1/3/89	[illegible]



△4
③
②
①
①
PIN 1
PIN 1
63812-000970-1
REV __
W6P1 (A1J5)
7.00 ±.25



1 +5 1
2 GND 2
3 RS 3
4 VO 4
5 E 5
6 R/W 6
7 BAD 1 7
8 BAD 0 8
9 BAD 3 9
10 BAD 2 10
11 BAD 5 11
12 BAD 4 12
13 BAD 7 13
14 BAD 6 14



③ △3
SN: ____
W6P4 (DS1)
PIN 1
PIN 1
-1

65480	2	DAT-42-292-1	MARKER, DATAB	W.H. BRADY CO.		3
15912	8"	171-14	28 AWG STRANDED FLAT CABLE	T AND B ANSLEY	US STYLE 2651	2
96906	2	M83503/7-02	14 POS RECEPTACLE CONN		M83503/7	1
FSCM NO	QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO.

PARTS LIST

APPLICATION
NEXT ASSY
000700

UNLESS OTHERWISE SPECIFIED

MATERIAL

10-22-87

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

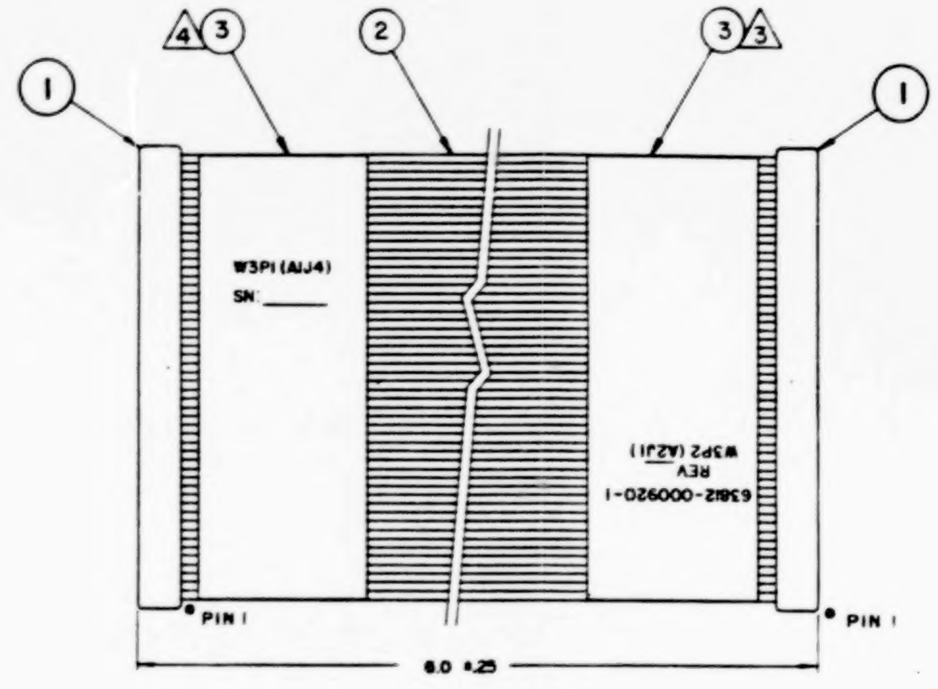
CABLE ASSY, LCD,
LORAN-C MONITOR

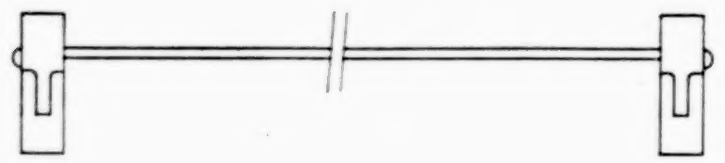
DTFA01-87-C-00006

63812 | D | 000970

SCALE NONE

SHEET 1 OF 1


1
4
3
2
3
3
1
W3P1 (A1J4)
SN: ______
63812-000920-1
REV
W3P2 (A2J1)
PIN 1
PIN 1
6.0 ±.25



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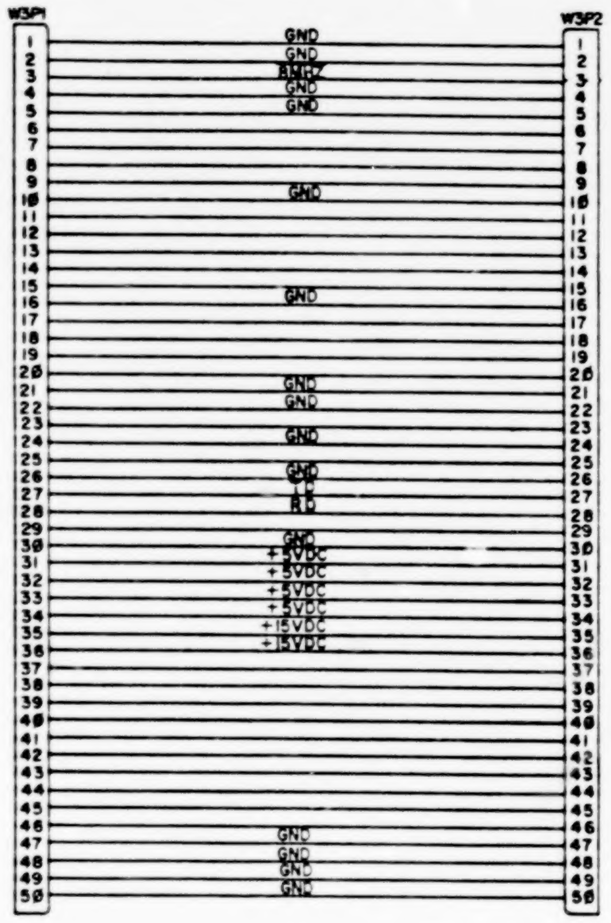

W3P1
W3P2
1 GND
2 GND
4 GND
5 GND
10 GND
16 GND
21 GND
22 GND
24 GND
26 GND
30 GND
31 +5VDC
32 +5VDC
33 +5VDC
34 +5VDC
35 +15VDC
36 +15VDC
47 GND
48 GND
49 GND
50 GND

REVISIONS

LTR	ZONE	DESCRIPTION	DATE	APPROVED
A	A6	CHG'D NOTE 3 4 PER E.O. 0046	-29-88	
B		REV PER E.O. NO. 0078	2-28-88	MRM
C		REV PER E.O. NO. 0243		
D		REV PER E.O. NO. 0351		
E		REL TO PROD, REV PER E.O. NO. 0463	1/5/??	FAS

PARTS LIST

FSCM NO	QTY REQD	DRAWING OR PART NO.	NOMENCLATURE OR DESCRIPTION	MANUFACTURER	SPECIFICATION	ITEM NO
						4
55480	2	DAT-42-292	MARKER, DATAB	W.H. BRADY CO.		3
15912	8"	171-50	28 AWG STRANDED FLAT CABLE	T AND B ANSLEY	U.L. STYLE 2656	2
96906	2	M83503/7-10	50 POS RECEPTICAL CONNECTOR		M83503/7	1

4. MARK REF. DES. AND SERIAL NO. ON ITEM 3 AS SHOWN PRIOR TO ASSEMBLY, BY TYPING

3. MARK PART NUMBER 63812-000920-1, APPROPRIATE REV LEVEL AND REF. DES. ON ITEM 3 AS SHOWN PRIOR TO ASSEMBLY, BY TYPING

2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9

NTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000 LEVEL 3

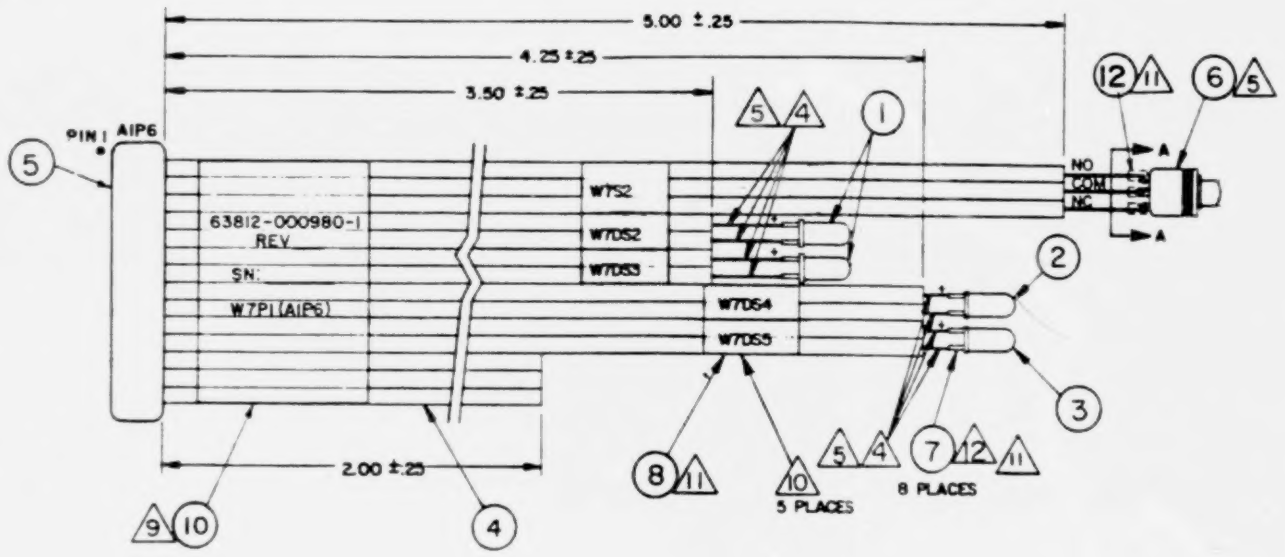
ES:

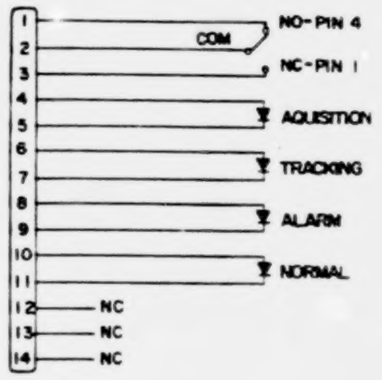
APPLICATION NEXT ASSY	000700
ORIGINAL DATE OF DRAWING	7-17-87
CONTRACT NO.	DTFA01-87-C-00006
	FRONTIER ENGINEERING INC. STILLWATER, OKLAHOMA 74075
	CABLE ASSY, RECEIVER, LORAN-C MONITOR
	63812
SIZE	D
	000920
SCALE	NONE
SHEET	1 OF 1

NOTES:

1. TRIM CONDUCTORS TO SPECIFIED LENGTH
2. STRIP 1/4" OF INSULATION OFF EACH CONDUCTOR
3. TRIM LED LEADS TO 1/4" LENGTH
4. INSTALL 3/8" LONG HEAT SHRINK TUBING OVER EACH CONDUCTOR
5. SOLDER LEDS AND SWITCH TO CONDUCTORS AS SHOWN ON DIAGRAM PER MIL-STD-454, REQUIREMENT 5, USING ITEM NO. 11
6. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
7. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
8.
9. MARK PART NO. 63812-000980-1, APPROPRIATE REV LEVEL, SERIAL NO. AND REF. DES. ON ITEM 10 AS SHOWN PRIOR TO ASSEMBLY, BY TYPING
10. MARK REFERENCE DESIGNATOR ON ITEM 8 AS SHOWN PRIOR TO ASSEMBLY TRIM OFF EXCESS AFTER MARKING
11. APPLY SUFFICIENT HEAT PER MIL-STD-454 REQUIREMENT 11, TO SHRINK ITEMS 7, 8, AND 12 FIRMLY ON WIRES
12. SOLDER PER MIL-STD-454, REQUIREMENT 5, USING ITEM NO. 11

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
A	D9	CHG'D NOTE 9 PER E.O. 0045	1-29-88	
B	—	REV PER E.O. NO. 0064	2-24-88	MEM
C	—	REV PER E.O. NO. 0240 & 0112	[illegible]	KE
D	—	REV PER E.O. NO. 0340		
E	—	REV PER E.O. NO. 0395	11/7/88	
F	—	REV PER E.O. NO. 0414	12/19/88	
G	—	REL TO PROD, REV PER E.O. NO. 0465	1/5/89	
H	—	REV PER EO 0502	2/24/89	


5.00 ± .25
4.25 ± .25
3.50 ± .25
2.00 ± .25
PIN 1
A1P6
5
63812-000980-1
REV
SN:
W7P1 (A1P6)
W7S2
W7DS2
W7DS3
W7DS4
W7DS5
5
4
1
12
11
6
5
NO
COM
NC
A
A
2
3
8
11
10
5 PLACES
5
4
7
12
11
8 PLACES
9
10
4


1
2
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4
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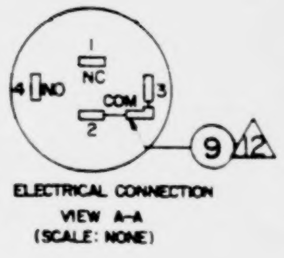
13
14
COM
NO-PIN 4
NC-PIN 1
AQUISITION
TRACKING
ALARM
NORMAL
NC
NC
NC


1
NC
4
NO
3
COM
2
9
12

ELECTRICAL CONNECTION
VIEW A-A
(SCALE: NONE)

-1

15740	1.13"	FIT-221-3/16	TUBING, HEAT SHRINK, 3/16"	ALPHA		12
81348	AR	SN63BS	SOLDER		QQ-S-571	11
85480	1	DAT-42-292	MARKER, DATAB	W.H. BRADY CO		10
96909	.5 IN.	BWA-2401	WIRE, BUS, 24 AWG	DE-MARZI-VICTOR		9
85480	5	HCPS.9-2508W	WIRE MARKER, HEAT SHRINK	W.H. BRADY CO		8
15740	4.12	FIT-221-1/16	TUBING, HEAT SHRINK, 1/16	ALPHA		7
96906	1	MS16712-1	SWITCH, PNL MNT, PUSH BTN		MS16712	6
96906	1	M83503/7-02	14 POSITION PLUG		M83503/7	5
15912	18.5	171-14	14 CONDUCTOR FLAT CABLE	T AND B ANSLEY		4
05464	1	LL233G	GREEN LED	INDUSTRIAL ELEC. ENG.		3
05464	1	LL203R	RED LED	INDUSTRIAL ELEC. ENG		2
05464	2	LL253Y	YELLOW LED	INDUSTRIAL ELEC. ENG.		1
FSCM NO	QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO

PARTS LIST

APPLICATION
NEXT ASSY
000700

END ITEM CODE NO.

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PLACE DECIMALS ± .01
3 PLACE DECIMALS ± .005
FRACTIONS ± 1/64
ANGLES ± 0°30'

MATERIAL

ORIGINAL DATE OF DRAWING 11-10-87
DRAFTSMAN
CHECKED
ENGINEER
APPROVED
APPROVED
CONTRACT NO.
DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

CABLE ASSY, LED, LORAN-C MONITOR

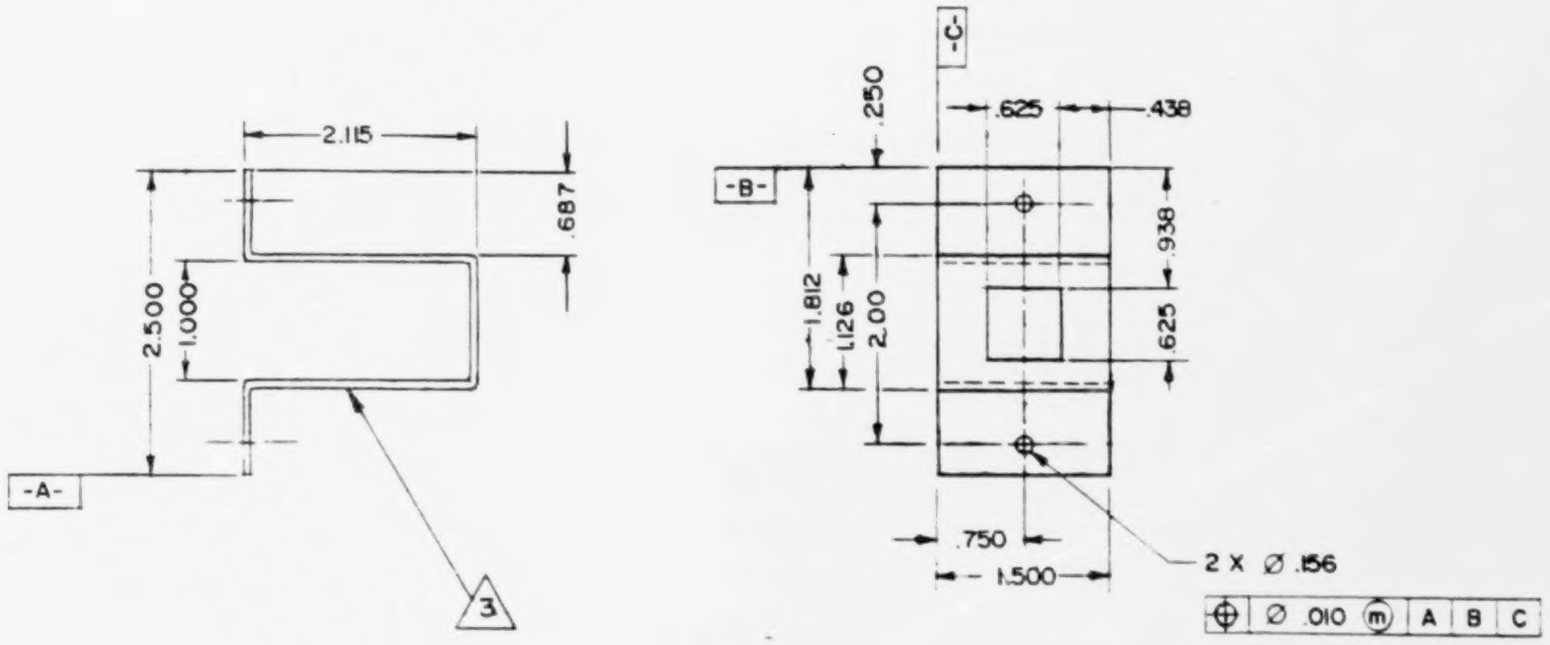
MANUFACTURING NO. 63812
SIZE D
000980
SCALE NONE
SHEET 1 of 1

NOTES:

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
3. MARK PART NUMBER 63812-001030-1 REV __ IN APPROXIMATE LOCATION SHOWN WITH .12 HIGH CHARACTERS USING BLACK EPOXY INK PEP FAA-G-2100, PARAGRAPH 3.9
4. CHEM FILM OR CLEAR ANODIZE PER FAA-G-2100, PARAGRAPH 3.7.6.2
5. ALL BEND RADII .03

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
A	REV PER E.O. # 0344		
B	REL TO PROD, REV PER E.O. NO. 0470	1/5/88	KAS



QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO.

LIST OF MATERIALS

APPLICATION
NEXT ASSY
000700
END ITEM CODE NO.

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PLACE DECIMALS ± .04
3 PLACE DECIMALS ± .010
FRACTIONS ± 1/16
ANGLES ± 0°30'

MATERIAL
.063 THK ALUMINUM
5052-H32 PER
QQA-250/8

ORIGINAL DATE OF DRAWING 8-3-87
DRAFTSMAN JW
CHECKER LC
SUBMITTED L Fitzgerald 11-15-87
APPROVED Keith 11/18/87
APPROVED 11/17/87
DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74076

BRACKET, BATTERY
LORAN-C MONITOR

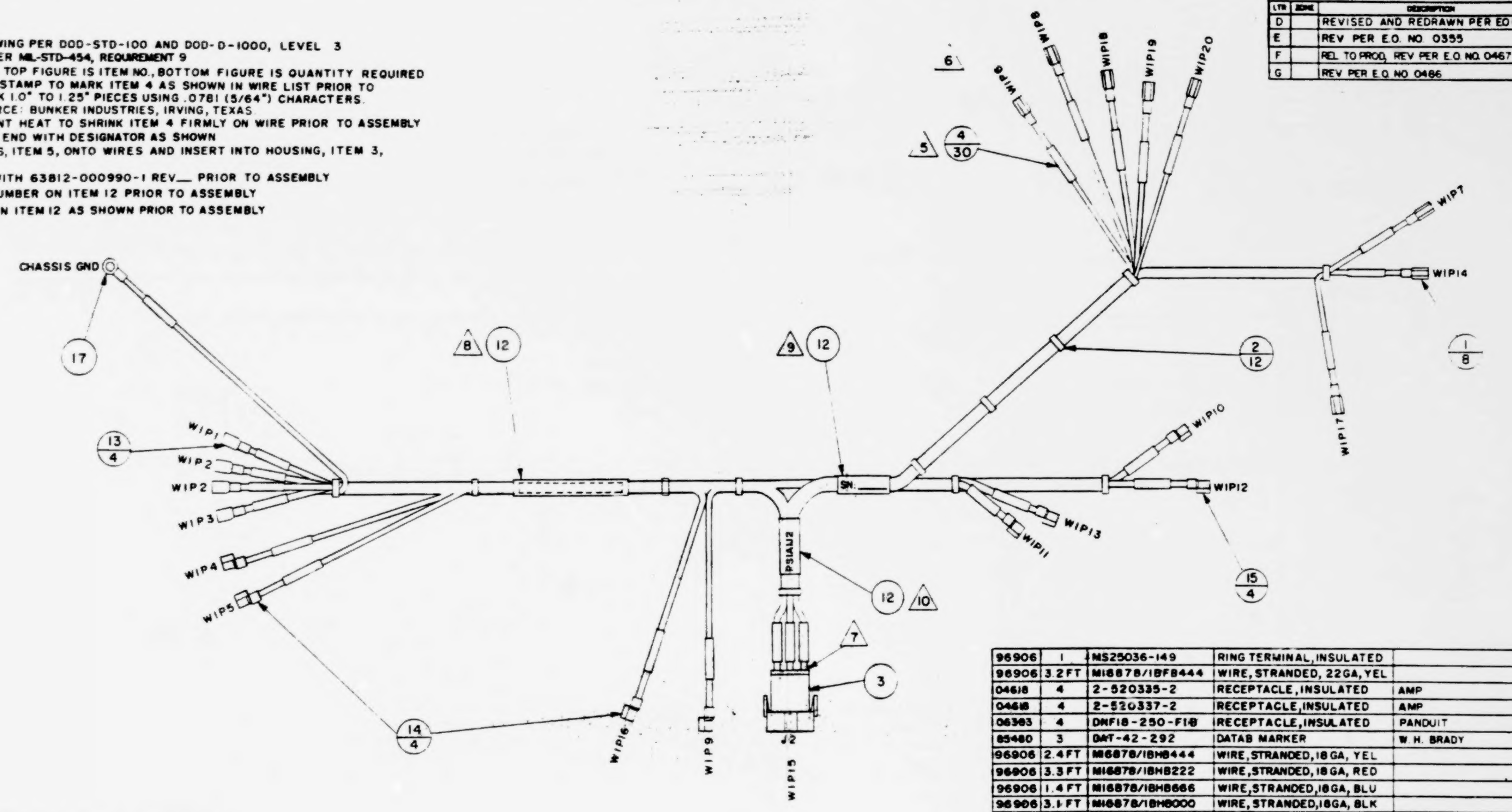
Manufacturing No. 63812
SIZE C
001030
SCALE 1/1
SHEET 1 OF 1

NOTES:

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
2. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
3. SPLIT BALLOON: TOP FIGURE IS ITEM NO., BOTTOM FIGURE IS QUANTITY REQUIRED
4. USE HEAT TYPE STAMP TO MARK ITEM 4 AS SHOWN IN WIRE LIST PRIOR TO ASSEMBLY. MARK 1.0" TO 1.25" PIECES USING .0781 (5/64") CHARACTERS. SUGGESTED SOURCE: BUNKER INDUSTRIES, IRVING, TEXAS.
5. APPLY SUFFICIENT HEAT TO SHRINK ITEM 4 FIRMLY ON WIRE PRIOR TO ASSEMBLY
6. ORIENTATE WIRE END WITH DESIGNATOR AS SHOWN
7. CRIMP CONTACTS, ITEM 5, ONTO WIRES AND INSERT INTO HOUSING, ITEM 3, PER WIRE LIST
8. MARK ITEM 12 WITH 63812-000990-1 REV__ PRIOR TO ASSEMBLY
9. MARK SERIAL NUMBER ON ITEM 12 PRIOR TO ASSEMBLY
10. MARK REF. DES. ON ITEM 12 AS SHOWN PRIOR TO ASSEMBLY

REVISIONS

LTR	ZONE	DESCRIPTION	DATE	APPROVED
D		REVISED AND REDRAWN PER EO 0251	5/18/88	
E		REV PER E.O. NO. 0355	10/20/88	
F		REL TO PROD, REV PER E.O. NO. 0467	1/5/89	
G		REV PER E.O. NO 0486	2/13/89	



WIRE LIST				4	4
WIRE	GAUGE	LENGTH	COLOR	FROM	TO
1	18	24.4	WHT	W1P1(J1P3)	W1P14(XFP1)
2	18	15.3	GRN	W1P2(J1P2)	W1P15P3
3	18	15.3	BLK	W1P3(J1P1)	W1P15P1
4	18	14.1	BLU	W1P4(BT1P1)	W1P16(BT2P2)
5	18	15.5	BLK	W1P5(BT1P2)	W1P15P9
6	18	16.4	WHT	W1P6(S1P1)	W1P15P2
7	18	5.1	WHT	W1P7(XFP2)	W1P17(S1P2)
8	18	16.2	RED	W1P8(S1P4)	W1P15P8
9	18	17.7	RED	W1P9(BT2P1)	W1P18(S1P3)
10	18	12.1	WHT	W1P10(T1P4)	W1P15P4
11	18	9.1	WHT	W1P11(T1P5)	W1P15P5
12	18	12.4	YEL	W1P12(T1P1)	W1P15P7
13	18	9.4	YEL	W1P13(T1P3)	W1P15P6
14	22	16.1	YEL	W1P19(S1P5)	W1P15P7
15	22	16.3	YEL	W1P20(S1P6)	W1P15P6
16	18	8.4	GRN	W1P2	CHASSIS GND

FSCM NO	QTY REQD	DRAWING OR PART NO	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO
96906	1	MS25036-149	RING TERMINAL, INSULATED			17
96906	3.2 FT	M16878/1BF8444	WIRE, STRANDED, 22GA, YEL		M16878/1B	16
04618	4	2-520335-2	RECEPTACLE, INSULATED	AMP		15
04618	4	2-520337-2	RECEPTACLE, INSULATED	AMP		14
06383	4	DNF18-250-F1B	RECEPTACLE, INSULATED	PANDUIT		13
85480	3	DAT-42-292	DATAB MARKER	W. H. BRADY		12
96906	2.4 FT	M16878/1BHB444	WIRE, STRANDED, 18 GA, YEL		M16878/1B	11
96906	3.3 FT	M16878/1BHB222	WIRE, STRANDED, 18 GA, RED		M16878/1B	10
96906	1.4 FT	M16878/1BHB666	WIRE, STRANDED, 18GA, BLU		M16878/1B	9
96906	3.1 FT	M16878/1BHB000	WIRE, STRANDED, 18GA, BLK		M16878/1B	8
96906	2.0 FT	M16878/1BHB555	WIRE, STRANDED, 18GA, GRN		M16878/1B	7
96906	7.0 FT	M16878/1BHB999	WIRE, STRANDED, 18GA, WHT		M16878/1B	6
04618	9	350550-2	CONTACTS, SOCKETS	AMP		5
06090	30	23053/5-109-3	WIRE MARKER, HEAT SHRINK	RAY-CHEM		4
04618	1	1-480706-0	HOUSING, 9 POSITION	AMP		3
06383	12	PLT1M	TIE, CABLE, NYLON	PANDUIT		2
06383	8	DNF18-206F1B	RECEPTACLE, INSULATED	PANDUIT		1

PARTS LIST

APPLICATION
NEXT ASSY
080700

5-9-88
dh

7/16/88
DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

CABLE ASSY, AC POWER,
LORAN-C MONITOR

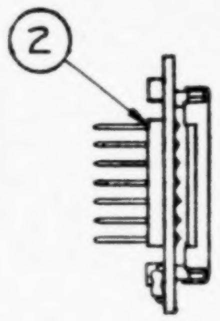
63812 | D | 000990

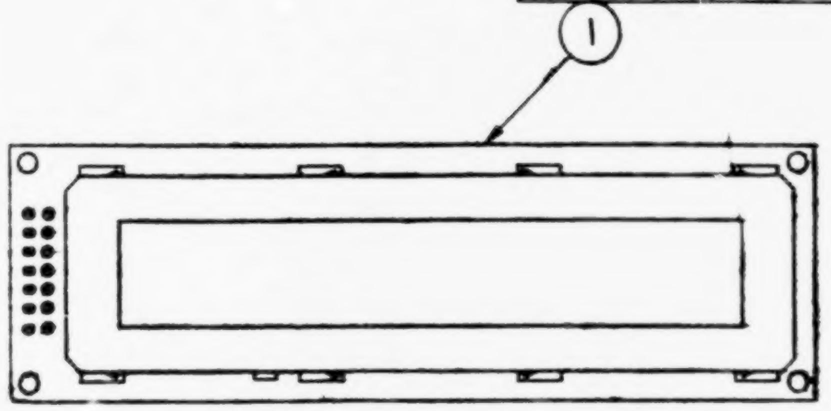
SCALE NONE
SHEET 1 OF 1

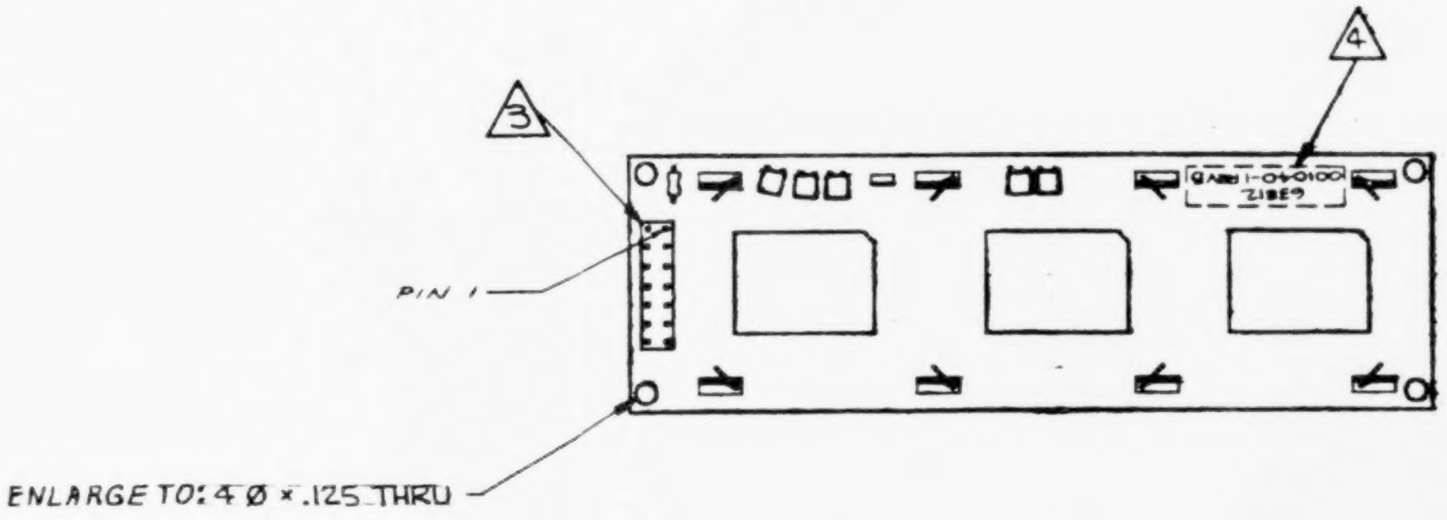
NOTES:

1. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3.
2. WORKMANSHIP PER MIL-STD-454 REQUIREMENT 9
3. SOLDER PER MIL-STD-454, REQUIREMENT 5 USING ITEM 3
4. MARK PART NUMBER 63812-001040-1 AND APPROPRIATE REVISION LETTER IN APPROXIMATE LOCATION SHOWN WITH .09 INCH HIGH CHARACTERS USING WHITE EPOXY INK PER FAA-G-2100, PARAGRAPH 3.9

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	REVISED PER E.O. NO. 0052	2/11/88	KS
B	REV PER E.O. NO. 0108	3/17/88	KS
C	REV PER EO. NO. 0184	4/11/88	KS
D	REV PER E.O # 0345	[illegible]	KS
E	REL TO PROD, REV PER E.O. NO. 0471	1/5/89	KS
F	REV PER EO 0523	3/20/89	PDC





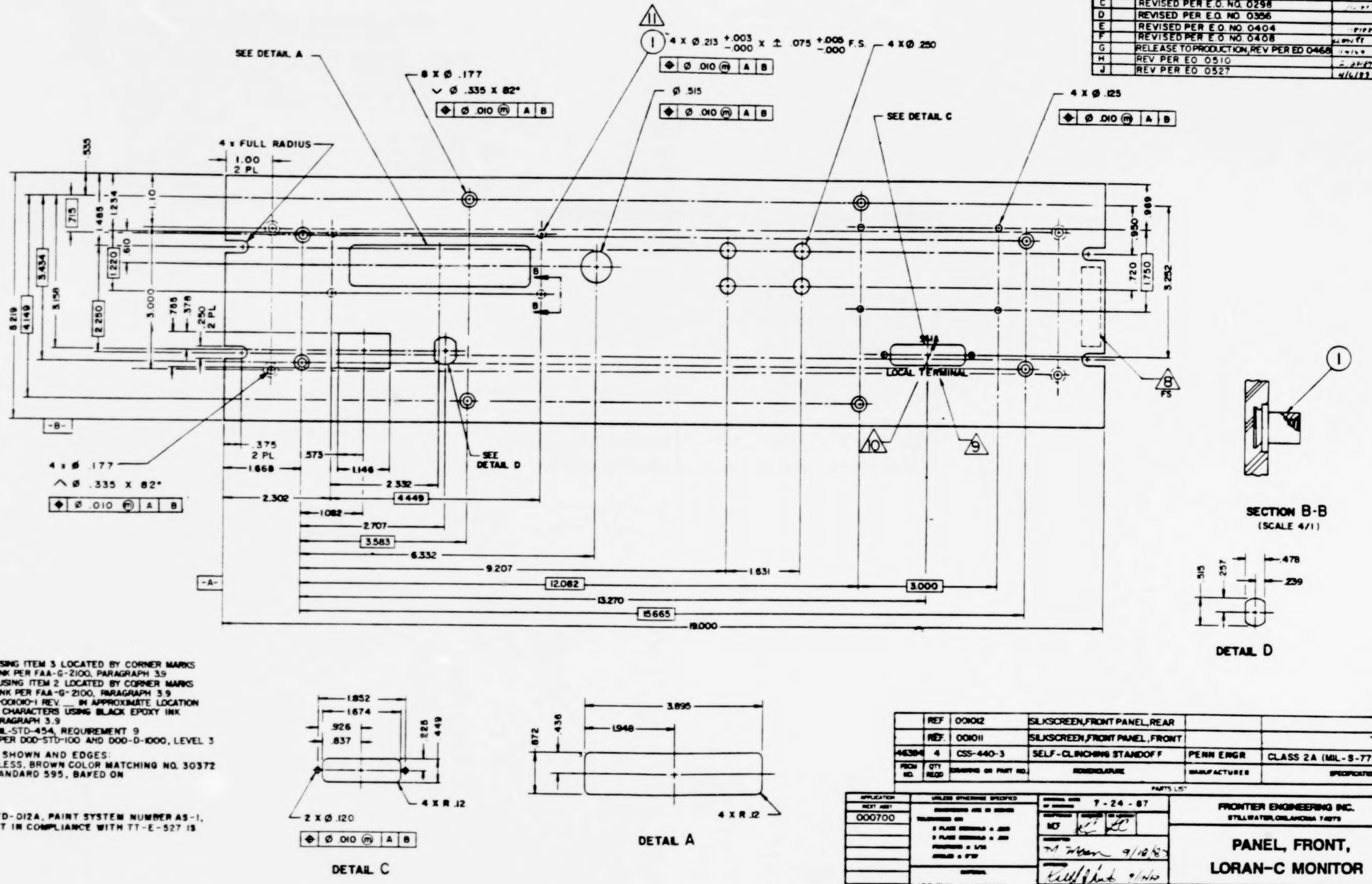


FSCM NO.	QTY REQD	DRAWING or PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO.
81348	AR	SN63BS	SOLDER		QQ-S-571	3
03554	1	8T227-7	CONNECTOR 14 POS. UNSHRD	AMPHENOL		2
62483	1	LM23AZC24CBH	DISPLAY, LIQUID CRYSTAL	DENSITRON		1

LIST OF MATERIALS

APPLICATION	UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING	FRONTIER ENGINEERING INC. STILLWATER, OKLAHOMA 74075
NEXT ASSY	DIMENSIONS ARE IN INCHES	DRAFTSMAN DT / CHECKED / GR LEADER	LCD ASSEMBLY, LORAN-C MONITOR
000700	TOLERANCES ON: 2 PLACE DECIMALS ± .04 3 PLACE DECIMALS ± .010 FRACTIONS ± 1/16 ANGLES ± 0°30'	SUBMITTED 11/11/87	
	MATERIAL	APPROVED 12/1/87	
END ITEM CODE NO.		APPROVED 12/20/87	Manufacturing No. 63812 / SIZE C / 001040
		CONTRACT NO. DTFA01-87-C-00006	SCALE NONE / SHEET

REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPROVED
A		REVISED PER E.O. NO. 0020	11-17-87	[illegible]
B		REVISED PER E.O. NO. 0030	[illegible]	[illegible]
C		REVISED PER E.O. NO. 0298	[illegible]	[illegible]
D		REVISED PER E.O. NO. 0356		
E		REVISED PER E.O. NO. 0404	[illegible]	KAS
F		REVISED PER E.O. NO. 0408	[illegible]	[illegible]
G		RELEASE TO PRODUCTION, REV PER EO 0468	[illegible]	KAS
H		REV PER EO 0510	[illegible]	[illegible]
J		REV PER EO 0527	4/6/89	[illegible]



SEE DETAIL A
8 X Ø .177
⌵ Ø .335 X 82°
Ø .010 Ⓜ A B
11
1
4 X Ø .213 +.003 −.000 X ± .075 +.005 −.000 F.S.
Ø .010 Ⓜ A B
Ø .515
Ø .010 Ⓜ A B
4 X Ø .250
SEE DETAIL C
4 X Ø .125
Ø .010 Ⓜ A B
4 x FULL RADIUS
1.00 2 PL
.335
.715
.485
1.234
.110
3.434
1.220
.610
8.219
4.149
3.158
2.250
3.000
.785
.378
.250 2 PL
.969
.930
.720
1.750
3.252
8
B
B
LOCAL TERMINAL
8
F.S.
10
9
-B-
4 x Ø .177
⌵ Ø .335 X 82°
Ø .010 Ⓜ A B
.375 2 PL
1.668
.573
1.146
SEE DETAIL D
2.332
4.449
2.302
1.082
2.707
3.583
6.332
9.207
1.631
12.082
3.000
13.270
15.665
19.000
-A-
1
SECTION B-B
(SCALE 4/1)
.515
.257
.478
.239
DETAIL D
1.852
1.674
.926
.837
.228
.449
2 X Ø .120
Ø .010 Ⓜ A B
4 X R .12
DETAIL C
3.895
1.948
.872
.436
4 X R .12
DETAIL A
-1

11 DO NOT DEBURR

10 SCREEN FAR SIDE USING ITEM 3 LOCATED BY CORNER MARKS WITH BLACK EPOXY INK PER FAA-G-2100, PARAGRAPH 3.9

9 SCREEN NEAR SIDE USING ITEM 2 LOCATED BY CORNER MARKS WITH BLACK EPOXY INK PER FAA-G-2100, PARAGRAPH 3.9

8 MARK PART NO. 63812-001010-1 REV. __ IN APPROXIMATE LOCATION SHOWN WITH .12 HIGH CHARACTERS USING BLACK EPOXY INK PER FAA-G-2100, PARAGRAPH 3.9

7. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9

6. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3

5. FINISH COAT SIDE SHOWN AND EDGES:
SMOOTH, LUSTERLESS, BROWN COLOR MATCHING NO. 30372 OF FEDERAL STANDARD 595, BAKED ON

4. NOT USED

3. NOT USED

2. NOT USED

1. PAINT PER FAA-STD-012A, PAINT SYSTEM NUMBER AS-1, EXCEPT THAT PAINT IN COMPLIANCE WITH TT-E-527 IS NOT REQUIRED

NOTES:

	REF	001012	SILKSCREEN, FRONT PANEL, REAR			3
	REF.	001011	SILKSCREEN, FRONT PANEL, FRONT			2
46384	4	CSS-440-3	SELF-CLINCHING STANDOFF	PENN ENGR	CLASS 2A (MIL-S-7742B)	1
FSCM NO.	QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO.

PARTS LIST

APPLICATION
NEXT ASSY
000700

UNLESS OTHERWISE SPECIFIED

MATERIAL
.125 THK ALUMINUM
5052-H32 PER
QQ-A-250/8

7-24-87
NC

M Wilson 9/18/87

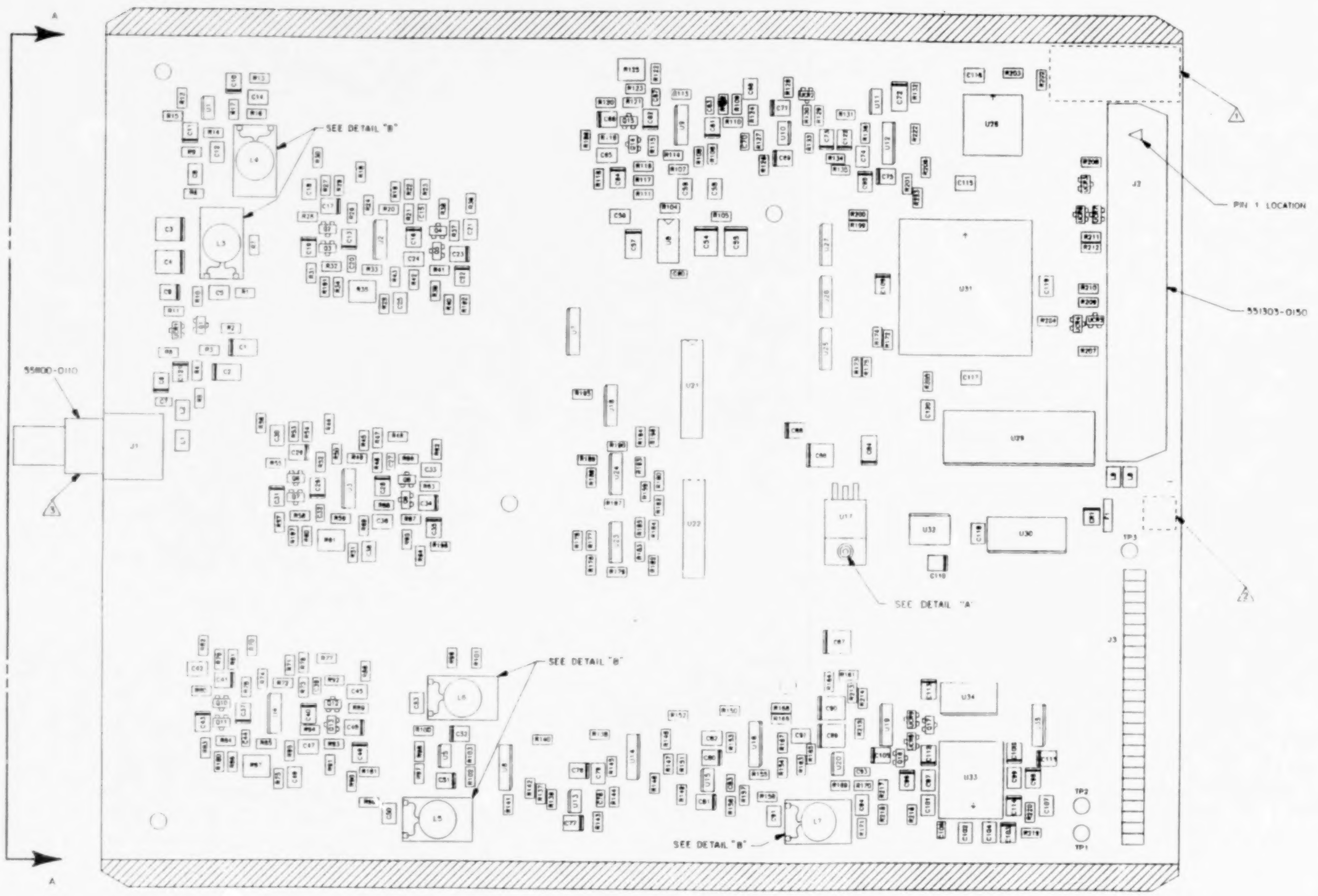
CONTRACT NO.
DTFA01-87-C-00006

FRONTIER ENGINEERING INC.
STILLWATER, OKLAHOMA 74075

PANEL, FRONT,
LORAN-C MONITOR

63812	D	001010
SCALE 1/1		SHEET 1 OF 1

ZONE	LTR	DESCRIPTION	DATE	APPD
	A	RELEASED	1/4/88	



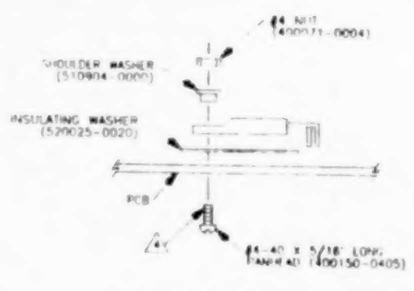
D
C
B
A
SEE DETAIL "B"
SEE DETAIL "A"
PIN 1 LOCATION
551303-0150
55R00-0110
J1
J2
J3
U31
U29
U30
U32
U34
U33
U28
U21
U22
TP1
TP2
TP3
L1
L3
L4
L5
L6
L7

4 INSTALL SCREWS WITH LOCTITE (GRADE C)

3 CONNECTOR J1 MUST BE INSTALLED FLUSH AND SQUARE TO PCB

2 ATTACH LABEL SAME LETTER AS REV OF DWG THIS AREA.

1 ATTACH SERIAL NUMBER LABEL THIS AREA



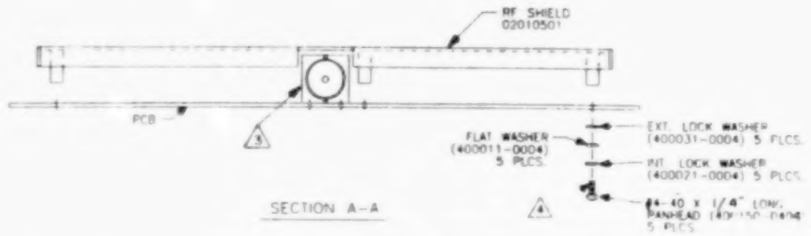
#4 NUT (400071-0004)
SHOULDER WASHER (510804-0000)
INSULATING WASHER (520025-0020)
PCB
4
#4-40 X 5/16" LONG PANHEAD (400150-0405)

DETAIL "A"

ADVANCED NAVIGATION, INC.

P R I V A T E

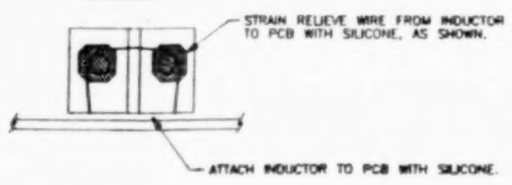
[illegible]



RF SHIELD 02010501
PCB
3
FLAT WASHER (400011-0004) 5 PLCS.
EXT. LOCK WASHER (400031-0004) 5 PLCS.
INT. LOCK WASHER (400021-0004) 5 PLCS.
4
#4-40 X 1/4" LONG PANHEAD (400150-0404) 5 PLCS.

SECTION A-A

DETAIL "B"



STRAIN RELIEVE WIRE FROM INDUCTOR TO PCB WITH SILICONE, AS SHOWN.
ATTACH INDUCTOR TO PCB WITH SILICONE.

NEXT ASSY	USED ON	REF DES	FIG NO
30410548	5300M		

APPLICATION

TOLERANCES
UNLESS OTHERWISE SPECIFIED
DECIMALS / FRACTIONS / ANGLES /

MATERIAL

ENGR [illegible] 2-3-88
CHECKED [illegible]
DRAWN M.L. YANKEE 11/21/87

ADVANCED NAVIGATION INC

PCB ASSY,
LORAN MONITOR

SIZE 4
CODE IDENT NO
10310526
A
SCALE 2:1
SHEET 1 OF 1

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	REV PER E.O.* 0346	12/17/88	[illegible]
B	REL TO PROD, REV PER E.Q. NO. 0469	1/5/89	KAS

NOTES

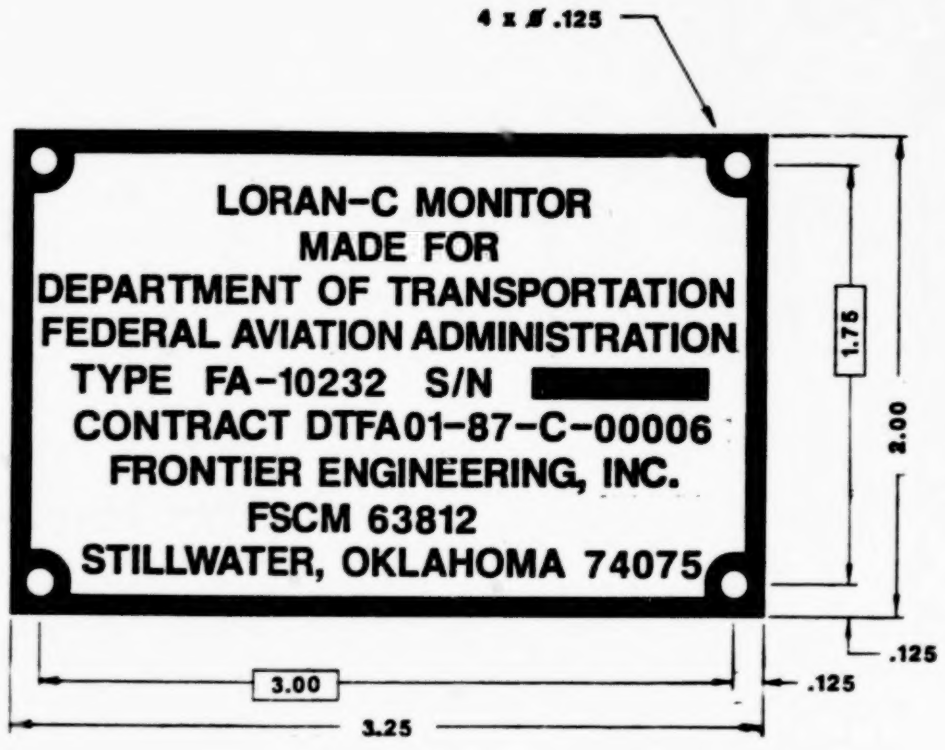
1. ACCEPTABLE MATERIALS:
   0.03 INCH MINIMUM ANODIZED ALUMINUM WITH OVERALL PROTECTIVE COATING OF CLEAR LACQUER, VARNISH, OR EPOXY

   OR 0.03 INCH CORROSION-RESISTANT STEEL, CLASS 302 OR CLASS 304 (ANY USE).

   PROCESS FOR BOTH OF ABOVE; REVERSE ETCHED; THE FOLLOWING TO BE RAISED, WITH DULL METAL FINISH; BORDER SERIAL NUMBER AND RATING DATA BLANKS, ALSO ALL LETTERING AND NUMBERS EXCEPT SERIAL NUMBER; DEPRESSED BACKGROUND FINISHED IN BLACK ENAMEL

   OR 0.02 INCH MINIMUM PHOTOSENSITIVE ANODIZED ALUMINUM PROCESSED FOR WHITE METAL CHARACTERS WITH JET BLACK BACKGROUND; PHOTOSENSITIVE SILVER COMPOUNDS SHALL BE EMBEDDED WITHIN THE OXIDE LAYER, AND IMAGE SHALL BE SEALED IN OXIDE LAYER BY CHEMICAL TREATMENT.

   OR 0.02 INCH MINIMUM PHOTOSENSITIVE ANODIZED ALUMINUM PROCESSED FOR DEPRESSED, ETCHED ALUMINUM CHARACTERS WITH RAISED BLACK ANODIZED BACKGROUND
2. SERIAL NUMBER: ENGRAVE OR DIE STAMP
3. IF NO CONTRACT NUMBER, SUBSTITUTE " ORDER NO. " FOR " CONTRACT "
4. INTERPRET DRAWING PER DOD-STD-100 AND DOD-D-1000, LEVEL 3
5. WORKMANSHIP PER MIL-STD-454, REQUIREMENT 9
6. EQUIPMENT TITLE, TYPE DESIGNATION, AND SERIAL NUMBERS, WILL BE FURNISHED BY GOVERNMENT AFTER AWARD OF CONTRACT
7. TOLERANCE ON DIMENSIONS ± 0.015 INCH, EXCEPT HOLE SIZE AND HOLE-TO-HOLE SPACING ± 0.005 INCH
8. SUBCONTRACTOR NAMEPLATE DESIGN IS MANDATORY WHERE EQUIPMENT IS MANUFACTURED BY SUBCONTRACTOR
9. CHARACTER GROUP TO BE CENTERED
10. CONDENSED TYPE MAY BE USED

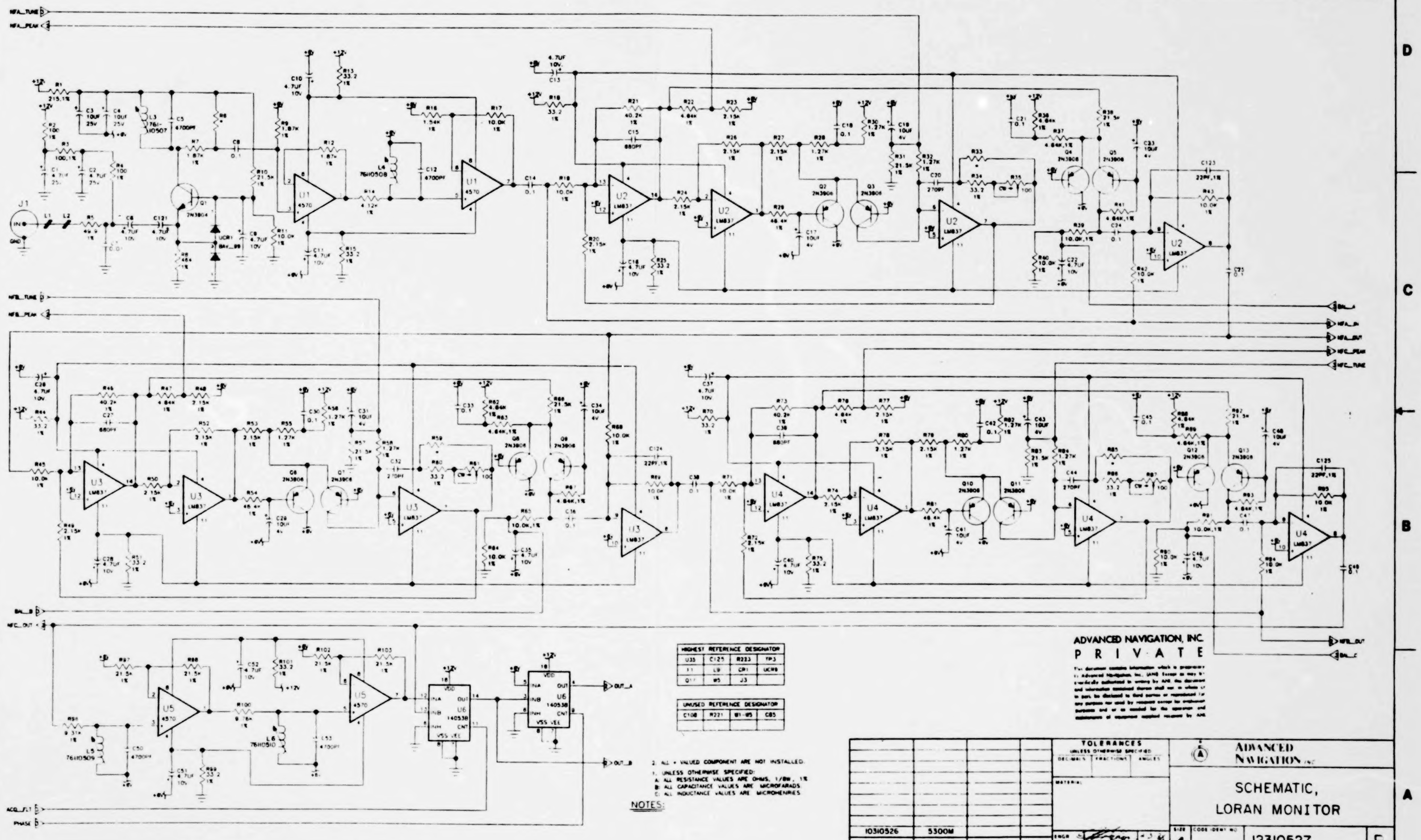

4 x ⌀ .125
LORAN-C MONITOR
MADE FOR
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
TYPE FA-10232 S/N
CONTRACT DTFA01-87-C-00006
FRONTIER ENGINEERING, INC.
FSCM 63812
STILLWATER, OKLAHOMA 74075
1.75
2.00
.125
.125
3.00
3.25

FSCM NO.	QTY REQD	DRAWING or PART NO.	NOMENCLATURE	MANUFACTURER	SPECIFICATION	ITEM NO.
	LIST OF MATERIALS					

APPLICATION	UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING 4-27-87	FRONTIER ENGINEERING INC. STILLWATER, OKLAHOMA 74075
NEXT ASSY 000700	DIMENSIONS ARE IN INCHES TOLERANCES ON: 2 PLACE DECIMALS ± .04 3 PLACE DECIMALS ± .010 FRACTIONS ± 1/16 ANGLES ± 0°30'	DRAFTSMAN MDF CHECKED LC DR LC	PLATE, IDENTIFICATION LORAN-C MONITOR
		SUBMITTED Michael R. Mann 11/16/87	
	MATERIAL	APPROVED Keith L. Schutz 11/16/87	
END ITEM CODE NO.	SEE NOTE I.	APPROVED Paul B. Chennell 11/17/87	Manufacturing No. 63812 | SIZE C | 001020
		CONTRACT NO. DTFA01-87-C-00006	SCALE NONE | SHEET

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPD
	A	RELEASED	8/1/87	
	B	ADDED C123-C125, PER E.C.O # 318	12/29/88	


D
C
B
A
NFA_TUNE
NFA_PEAK
J1
IN
GND
U1 4570
Q1 2N3904
U2 LM837
U3 LM837
U4 LM837
U5 4570
U6 14053B
NFB_TUNE
NFB_PEAK
BAL_A
NFA_IN
NFA_OUT
NFC_PEAK
NFC_TUNE
BAL_B
NFC_OUT
NFB_OUT
BAL_C
ACQ_FLT
PHASE
OUT_A
OUT_B

HIGHEST REFERENCE DESIGNATOR			
U35	C125	R223	TP3
F1	L9	CR1	UCR8
Q17	W5	J3	

UNUSED REFERENCE DESIGNATOR			
C108	R221	W1-W5	C85

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   A: ALL RESISTANCE VALUES ARE OHMS, 1/8W, 1%
   B: ALL CAPACITANCE VALUES ARE MICROFARADS
   C: ALL INDUCTANCE VALUES ARE MICROHENRIES
2. ALL * VALUED COMPONENT ARE NOT INSTALLED.

ADVANCED NAVIGATION, INC
PRIVATE

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10310526	5300M		
NEXT ASSY	USED ON	REF DES	FIG NO
APPLICATION			

TOLERANCES
UNLESS OTHERWISE SPECIFIED
DECIMALS | FRACTIONS | ANGLES

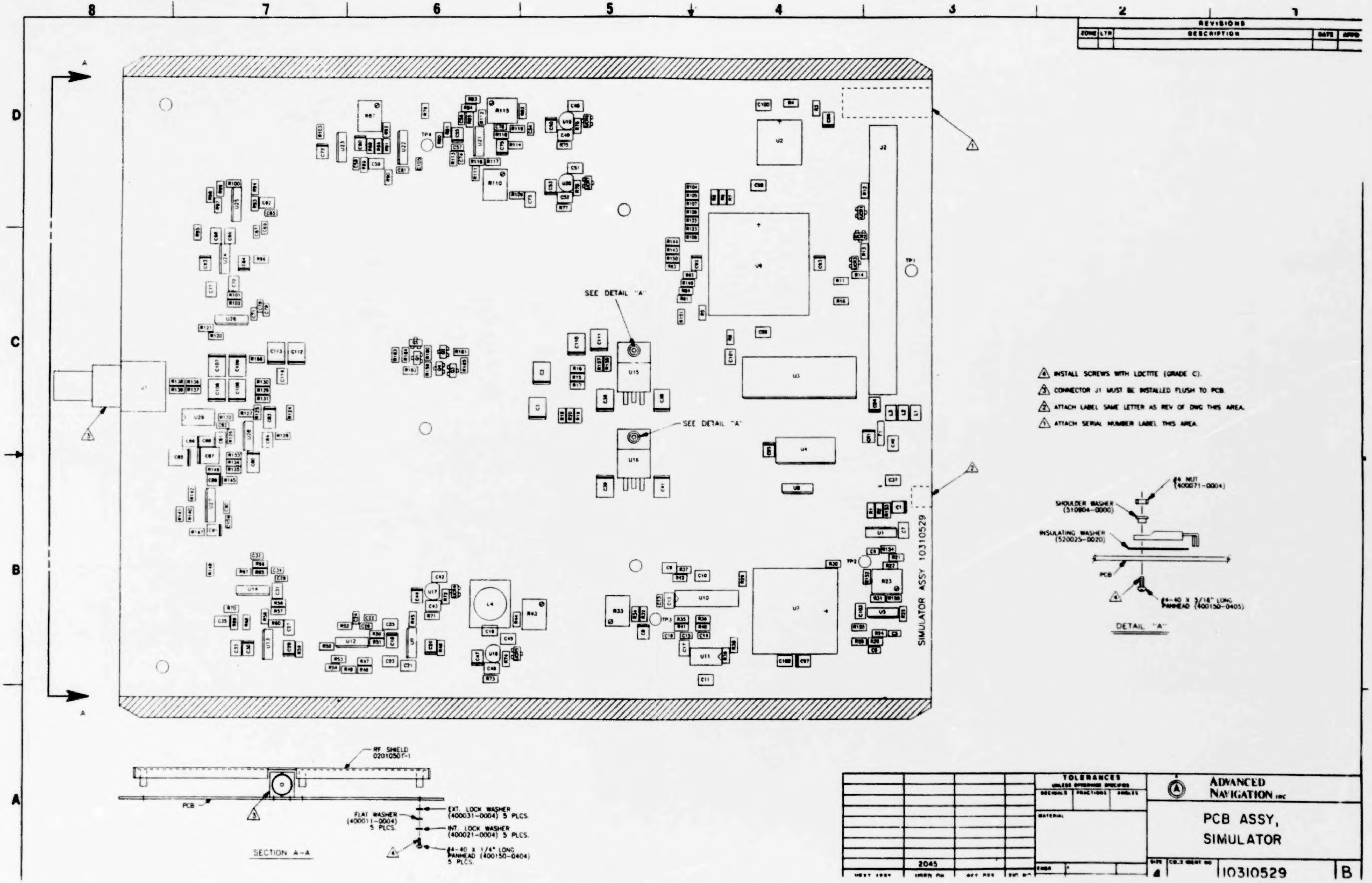
MATERIAL

ENGR
CHECKED
DRAWN M.L. YANKEE 11/23/87

ADVANCED NAVIGATION INC

SCHEMATIC,
LORAN MONITOR

SIZE 4 | CODE IDENT NO | 12310527 | B
SCALE N/A | SHEET 1 OF 4


8
7
6
5
4
3
2
1
D
C
B
A
REVISIONS
ZONE
LTR
DESCRIPTION
DATE
APPD
SEE DETAIL "A"
SEE DETAIL "A"
SIMULATOR ASSY 10310529
J1
J2
U2
U3
U4
U6
U7
U15
U16
TP1
TP2
TP3
TP4
RF SHIELD 0201050T-1
PCB
FLAT WASHER (400011-0004) 5 PLCS.
EXT. LOCK WASHER (400031-0004) 5 PLCS.
INT. LOCK WASHER (400021-0004) 5 PLCS.
#4-40 X 1/4" LONG PANHEAD (400150-0404) 5 PLCS.
SECTION A-A
#4 NUT (400071-0004)
SHOULDER WASHER (510904-0000)
INSULATING WASHER (520025-0020)
PCB
#4-40 X 3/16" LONG PANHEAD (400150-0405)
DETAIL "A"

4. INSTALL SCREWS WITH LOCTITE (GRADE C).
3. CONNECTOR J1 MUST BE INSTALLED FLUSH TO PCB.
2. ATTACH LABEL SAME LETTER AS REV OF DWG THIS AREA.
1. ATTACH SERIAL NUMBER LABEL THIS AREA.

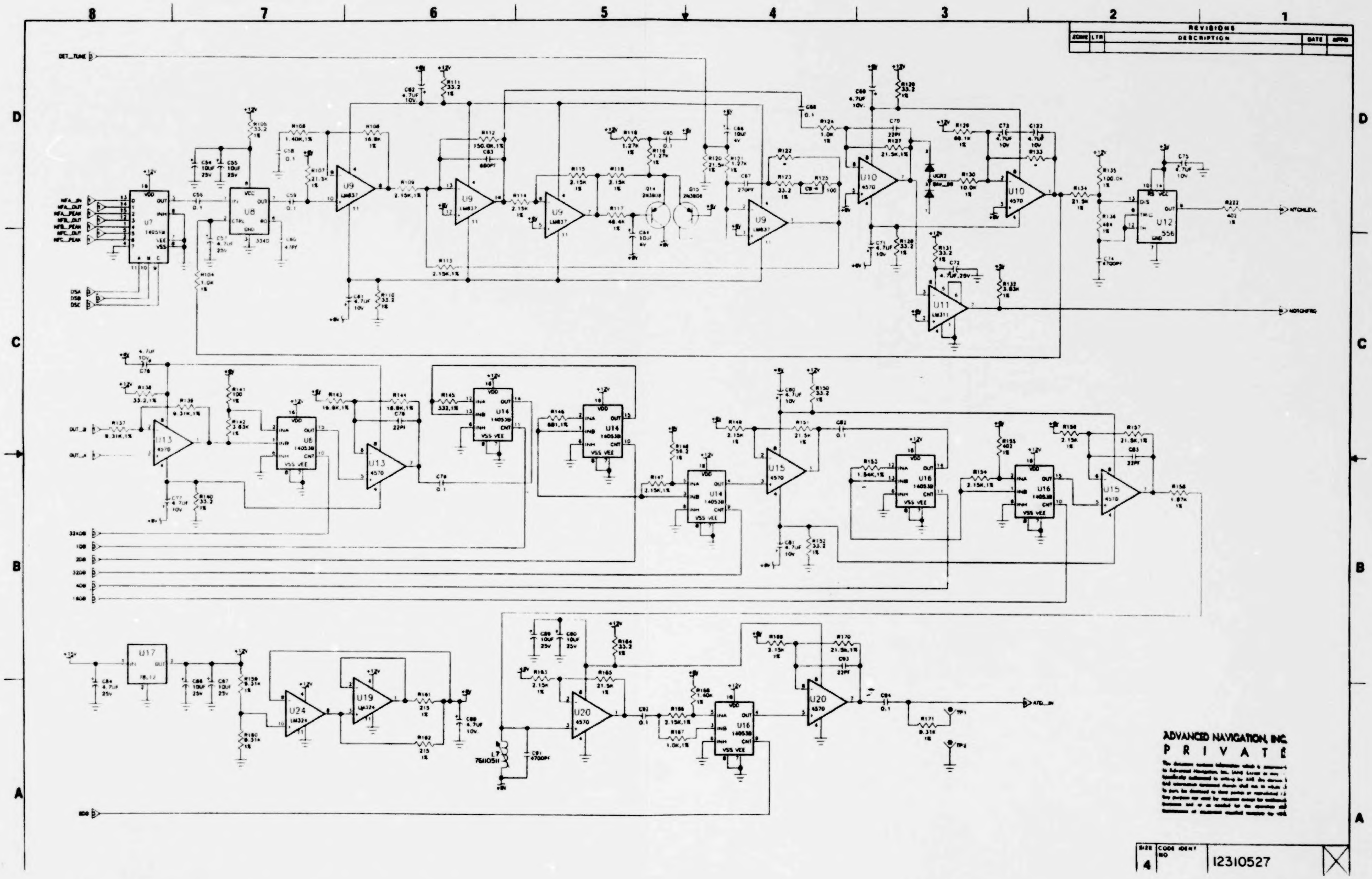
TOLERANCES
UNLESS OTHERWISE SPECIFIED
DECIMALS FRACTIONS ANGLES
MATERIAL

2045
NEXT ASSY USED ON

ADVANCED NAVIGATION INC

PCB ASSY,
SIMULATOR

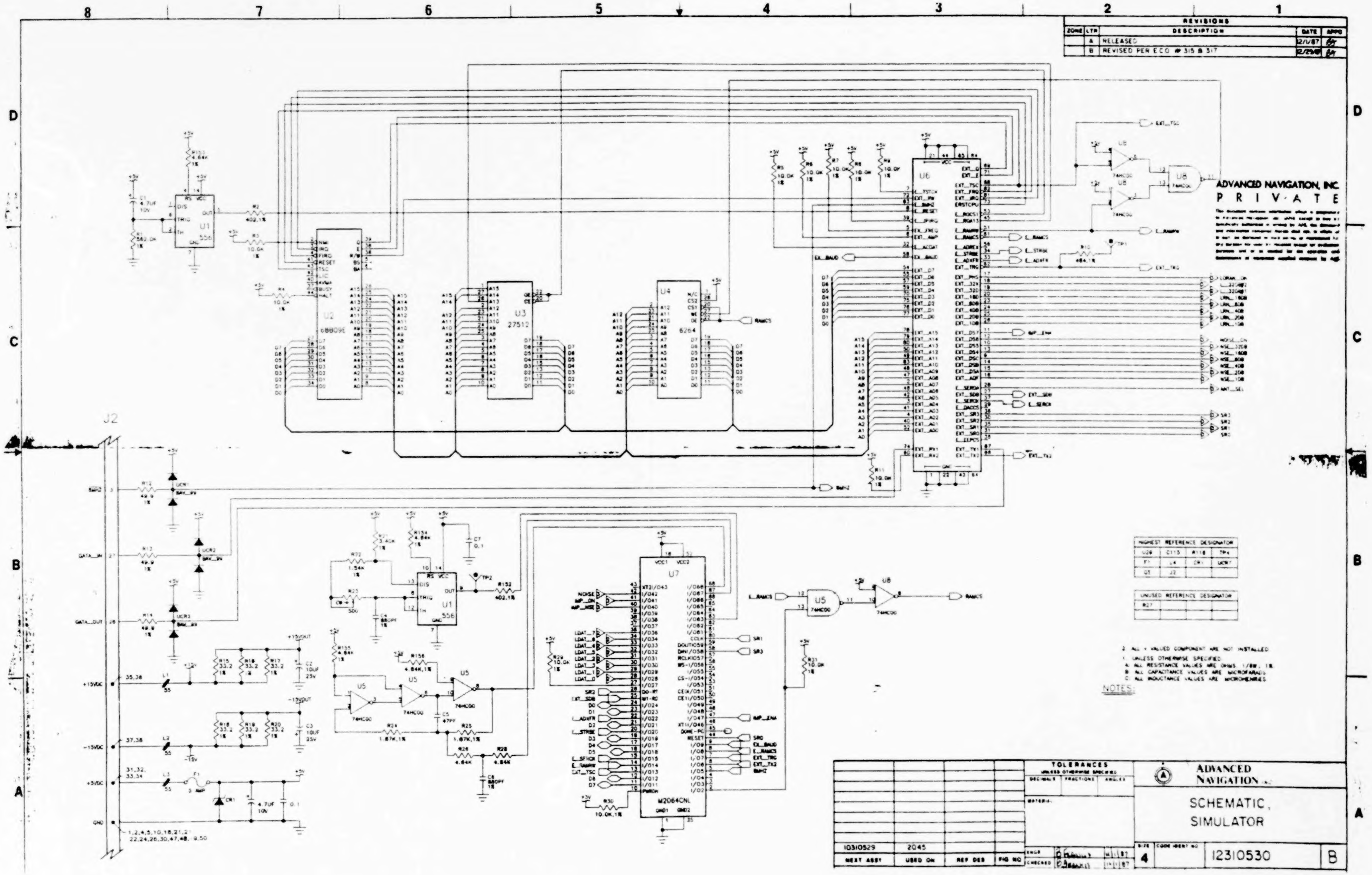
SIZE A
10310529
B


8
7
6
5
4
3
2
1
D
C
B
A
REVISIONS
ZONE
LTR
DESCRIPTION
DATE
APPD
DET_TUNE
NFA_IN
NFA_OUT
NFA_PEAK
NFB_OUT
NFB_PEAK
NFC_OUT
NFC_PEAK
DSA
DSB
DSC
U7
14051B
U8
3340
U9
LM837
U10
4570
U11
LM311
U12
556
NTCHLEVL
NOTCHFRQ
OUT_B
OUT_A
U13
4570
U6
14053B
U14
14053B
U15
4570
U16
14053B
32XDB
1DB
2DB
32DB
4DB
16DB
U17
78L12
U24
LM324
U19
LM324
L7
7611051I
U20
4570
ATG_IN
TP1
TP2
SDB
+12V
+8V

ADVANCED NAVIGATION, INC.
P R I V A T E

[illegible]

SIZE	CODE IDENT NO		
4		12310527	☒



8
7
6
5
4
3
2
1
D
C
B
A
U1
556
U2
6809E
U3
27512
U4
6264
U6
U7
M2064CNL
U5
74HC00
U8
J2

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	RELEASED	2/1/87	
	B	REVISED PER ECO # 315 & 317	2/29/88	

ADVANCED NAVIGATION, INC.

P R I V A T E

[illegible]

HIGHEST REFERENCE DESIGNATOR			
U20	C115	R118	TP4
F1	L4	CR1	UCR7
Q5	J2		

UNUSED REFERENCE DESIGNATOR			
R27			

2. ALL * VALUED COMPONENT ARE NOT INSTALLED.
1. UNLESS OTHERWISE SPECIFIED
A. ALL RESISTANCE VALUES ARE OHMS, 1/8W, 1%.
B. ALL CAPACITANCE VALUES ARE MICROFARADS.
C. ALL INDUCTANCE VALUES ARE MICROHENRIES.

NOTES:

10310529	2045		
NEXT ASSY	USED ON	REF DES	FIG NO

TOLERANCES
UNLESS OTHERWISE SPECIFIED
DECIMALS | FRACTIONS | ANGLES

MATERIAL

ENGR 11/1/87
CHECKED 11/1/87

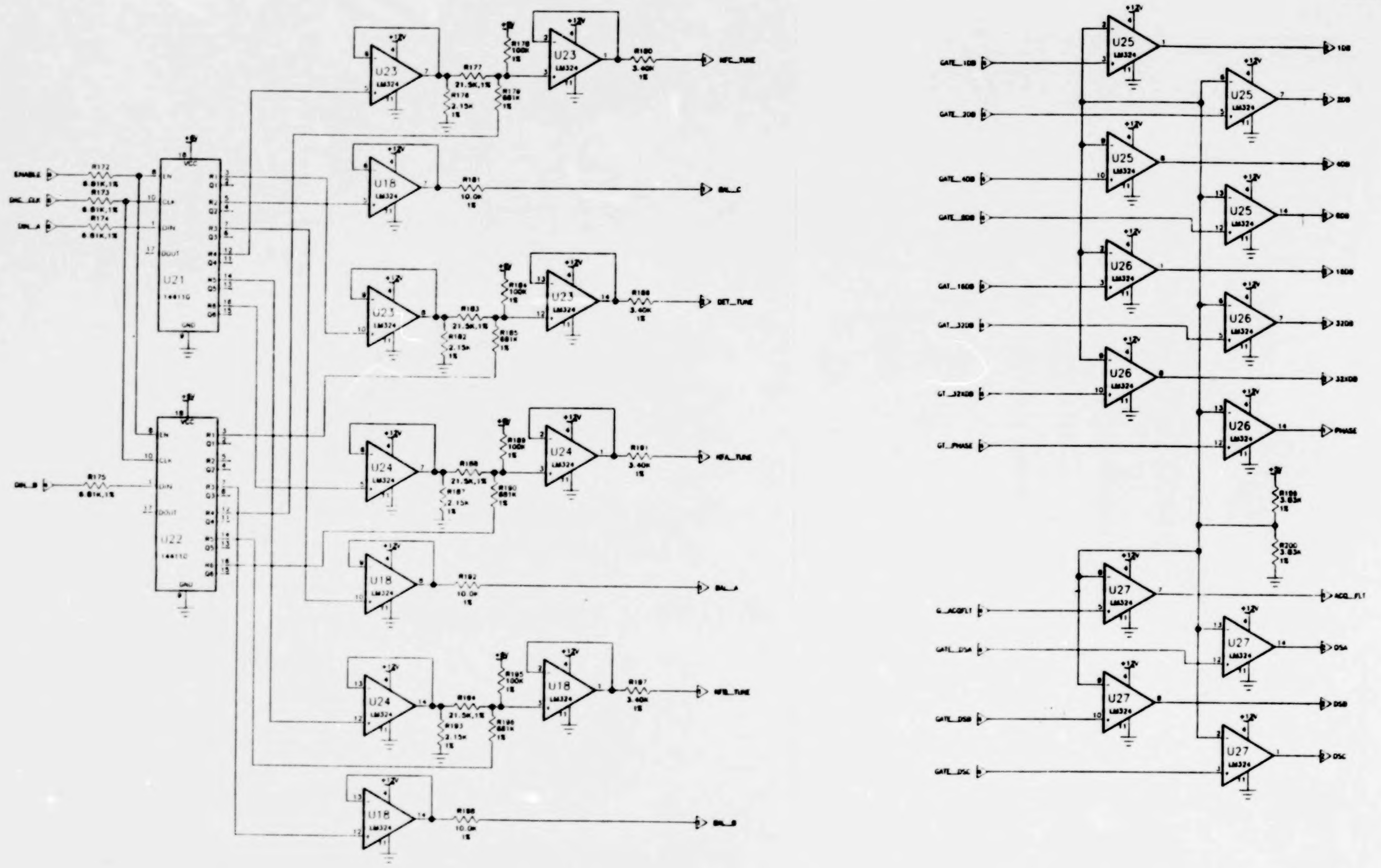
ADVANCED
NAVIGATION INC.

SCHEMATIC,
SIMULATOR

SIZE 4 | CODE IDENT NO | 12310530 | B

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPD

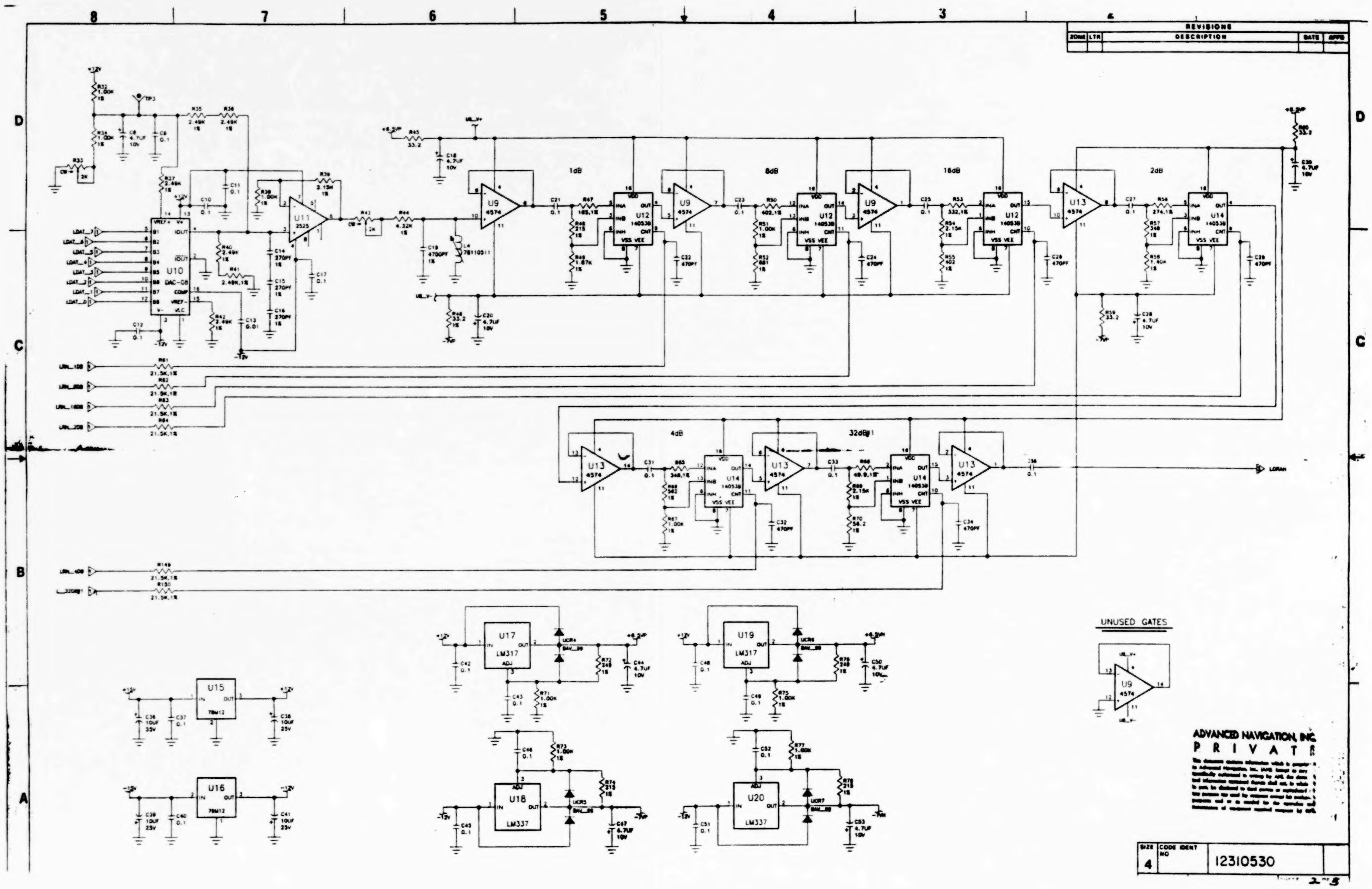

ENABLE
DAC_CLK
DIN_A
DIN_B
R172 6.81K,1%
R173 6.81K,1%
R174 6.81K,1%
R175 6.81K,1%
+5V
VCC
EN
CLK
DIN
DOUT
GND
U21
144110
U22
144110
R1 Q1 R2 Q2 R3 Q3 R4 Q4 R5 Q5 R6 Q6
U23
U24
U18
LM324
+12V
R177 21.5K,1%
R178 2.15K 1%
R179 681K 1%
R176 100K 1%
R180 3.40K 1%
HFC_TUNE
R181 10.0K 1%
BAL_C
R183 21.5K,1%
R182 2.15K 1%
R185 681K 1%
R184 100K 1%
R186 3.40K 1%
DET_TUNE
R188 21.5K,1%
R187 2.15K 1%
R190 681K 1%
R189 100K 1%
R191 3.40K 1%
HFA_TUNE
R192 10.0K 1%
BAL_A
R194 21.5K,1%
R193 2.15K 1%
R196 681K 1%
R195 100K 1%
R197 3.40K 1%
HFB_TUNE
R198 10.0K 1%
BAL_B
GATE_1DB
GATE_2DB
GATE_4DB
GATE_8DB
GAT_16DB
GAT_32DB
GT_32XDB
GT_PHASE
G_ACQFLT
GATE_DSA
GATE_DSB
GATE_DSC
U25
U26
U27
1DB
2DB
4DB
8DB
16DB
32DB
32XDB
PHASE
ACQ_FLT
DSA
DSB
DSC
R199 3.83K 1%
R200 3.83K 1%

ADVANCED NAVIGATION, INC.

P R I V A T E

[illegible]

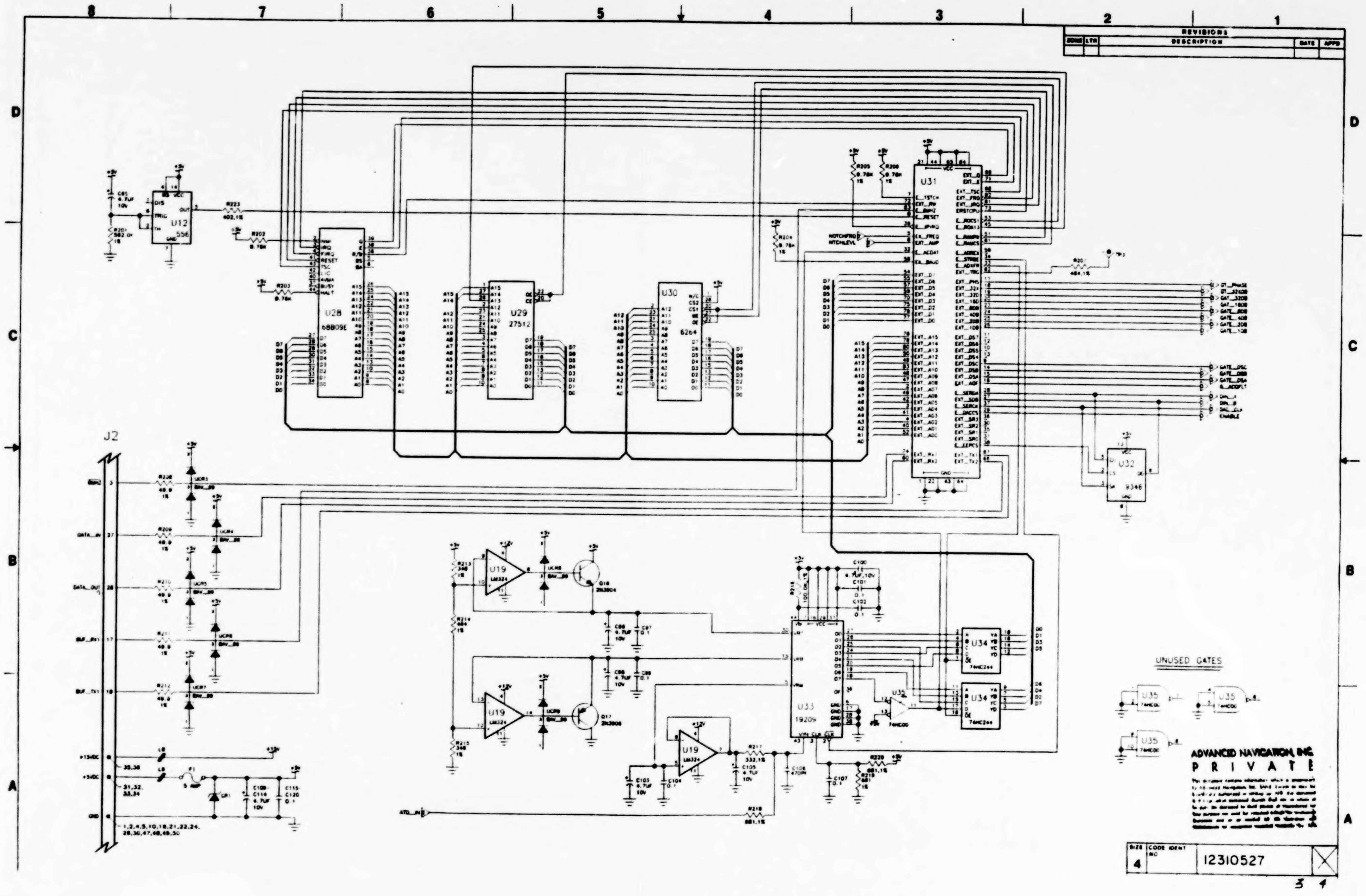
SIZE 4	CODE IDENT NO	12310527	☒
SCALE N/A		SHEET 3 OF 4	

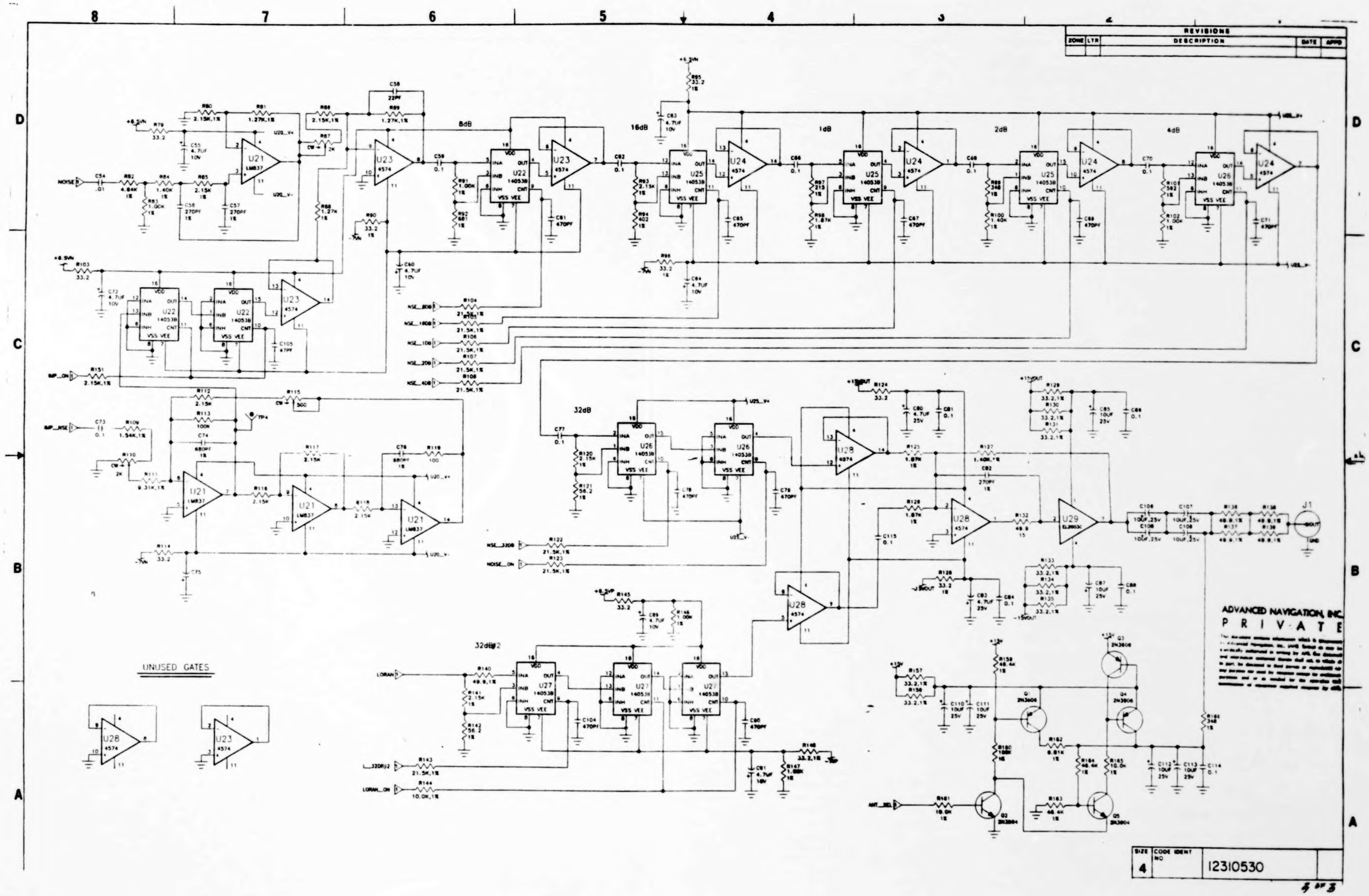

REVISIONS
ZONE
LTR
DESCRIPTION
DATE
APPD
8
7
6
5
4
3
2
D
C
B
A
U10
DAC-08
U11
2525
U9
4574
U12
14053B
U13
4574
U14
14053B
1dB
8dB
16dB
2dB
4dB
32dB
LDAT_7
LDAT_6
LDAT_5
LDAT_4
LDAT_3
LDAT_2
LDAT_1
LDAT_0
LRN_1DB
LRN_8DB
LRN_16DB
LRN_2DB
LRN_4DB
LRN_32DB
LORAN
TP3
L4
78110511
U15
78M12
U16
79M12
U17
LM317
U18
LM337
U19
LM317
U20
LM337
UCR4
UCR5
UCR6
UCR7
BAV_99
+12V
-12V
+6.2VP
-7VP
UNUSED GATES

ADVANCED NAVIGATION, INC.
PRIVATE

SIZE	CODE IDENT NO	
4		12310530

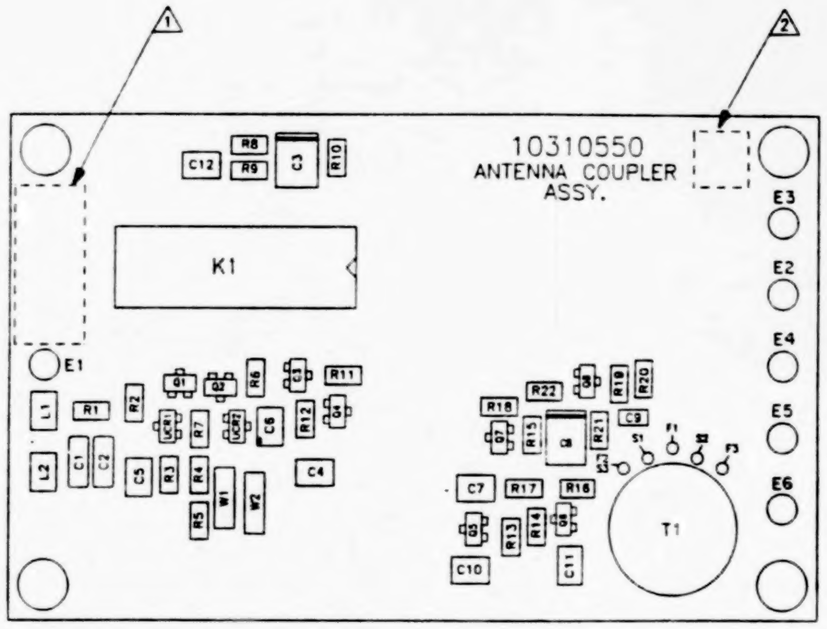
2 of 5

8
7
6
5
4
3
2
1
D
C
B
A
REVISIONS
ZONE
LTR
DESCRIPTION
DATE
APPD
U12
556
U28
68B09E
U29
27512
U30
6264
U31
U32
9346
U33
19209
U34
74HC244
U35
74HC00
U19
LM324
Q16
2N3904
Q17
2N3906
J2
DATA_IN
DATA_OUT
BUF_RX1
BUF_TX1
+15VDC
+5VDC
GND
F1
3 AMP
ATD_IN
UNUSED GATES
ADVANCED NAVIGATION, INC.
PRIVATE
SIZE
4
CODE IDENT NO
12310527
3
4


8
7
6
5
4
3
2
1
D
C
B
A
REVISIONS
ZONE
LTR
DESCRIPTION
DATE
APPD
NOISE
U21
LM837
U22
14053B
U23
4574
U24
U25
U26
U27
U28
U29
EL2003C
8dB
16dB
1dB
2dB
4dB
32dB
32dB/2
NSE_8DB
NSE_16DB
NSE_1DB
NSE_2DB
NSE_4DB
NSE_32DB
NOISE_ON
IMP_ON
IMP_NSE
LORAN
L_32DB/2
LORAN_ON
ANT_SEL
U20_V+
U20_V-
U25_V+
U25_V-
+6.5VN
-7VN
+15VOUT
-15VOUT
TP4
J1
RFOUT
GND
Q1
Q2
Q3
Q4
Q5
2N3906
2N3904
UNUSED GATES
ADVANCED NAVIGATION, INC.
PRIVATE
SIZE
4
CODE IDENT NO
12310530

3 of 3

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	RELEASED	1/4/88	


1
2
10310550
ANTENNA COUPLER
ASSY.
K1
E1
E2
E3
E4
E5
E6
C12
R8
R9
C3
R10
Q1
Q2
R6
Q3
R11
L1
R1
R2
VCR1
R7
VCR2
C6
R12
Q4
L2
C1
C2
C5
R3
R4
W1
W2
C4
R5
R22
Q8
R19
R20
R18
Q7
R15
Q9
R21
C9
S1
F1
S2
F3
C7
R17
R16
Q5
R13
R14
Q6
C10
C11
T1

NOTES:

1. MARK SERIAL NUMBER THIS AREA.
2. ATTACH LABEL SAME LETTER AS REV OF DWG THIS AREA.

ADVANCED NAVIGATION, INC.
PRIVATE
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22010602	5300M		
NEXT ASSY	USED ON	REF DES	FIG NO
APPLICATION			

TOLERANCES UNLESS OTHERWISE SPECIFIED		
DECIMALS	FRACTIONS	ANGLES
/	/	/

MATERIAL

ENGR		2-3-88
CHECKED		
DRAWN	M.L. YANKEE	12/1/87

ADVANCED NAVIGATION INC

PCB ASSY, ANTENNA COUPLER

SIZE	CODE IDENT NO		
3		10310550	A
SCALE 2:1			SHEET 1 OF 1

4 3 2 1

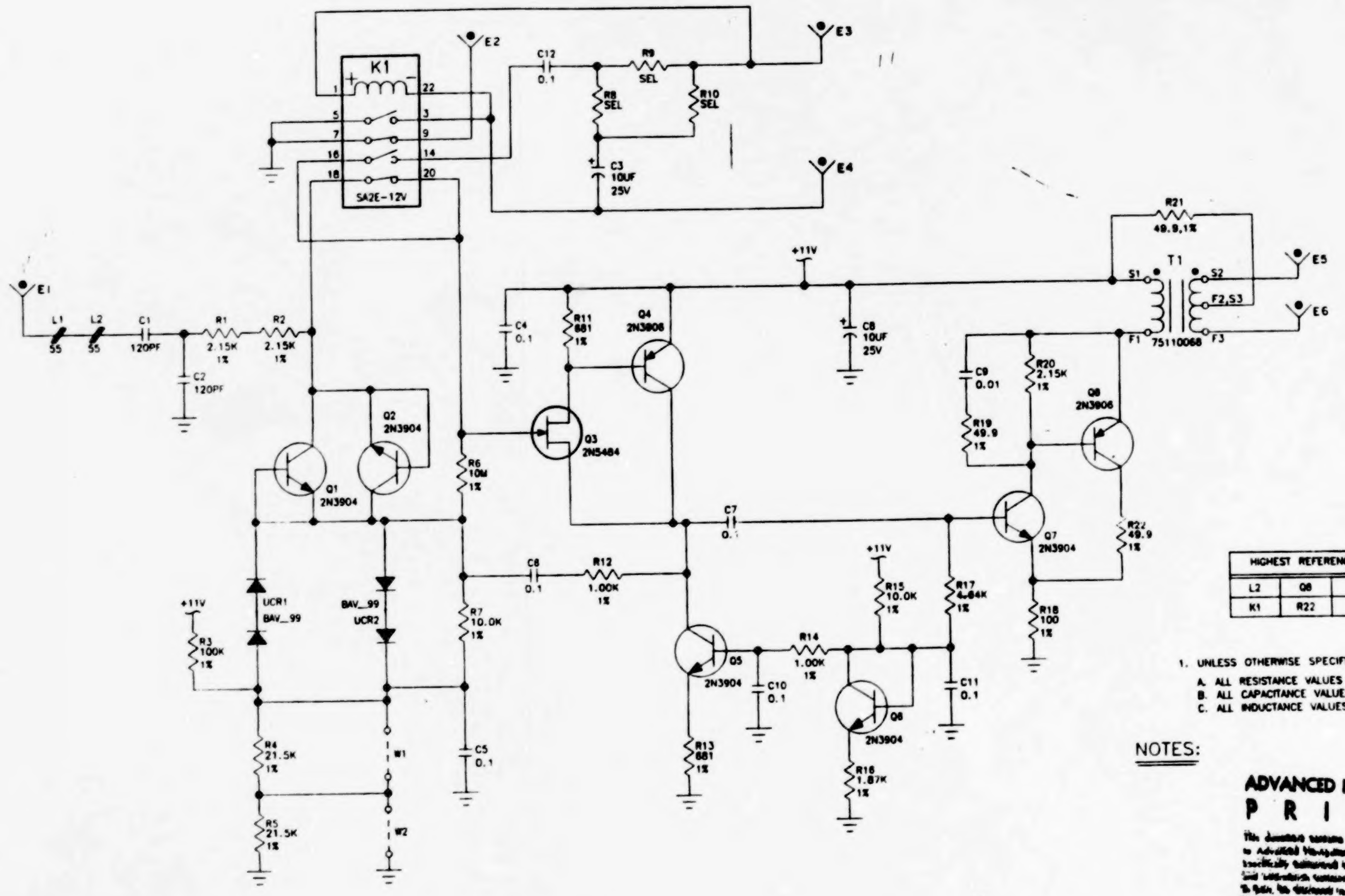
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	RELEASED	1/4/88	

D

C

B

A


K1
SA2E-12V
1
22
5
3
7
9
16
14
18
20
E2
E3
E4
C12
0.1
R9
SEL
R8
SEL
R10
SEL
C3
10UF
25V
E1
L1
55
L2
55
C1
120PF
C2
120PF
R1
2.15K
1%
R2
2.15K
1%
Q1
2N3904
Q2
2N3904
UCR1
BAV_99
BAV_99
UCR2
+11V
R3
100K
1%
R4
21.5K
1%
R5
21.5K
1%
W1
W2
R6
10M
1%
R7
10.0K
1%
C5
0.1
C4
0.1
R11
881
1%
Q4
2N3906
Q3
2N5484
+11V
C8
10UF
25V
C7
0.1
C8
0.1
R12
1.00K
1%
Q5
2N3904
C10
0.1
R13
881
1%
R14
1.00K
1%
+11V
R15
10.0K
1%
Q6
2N3904
R16
1.87K
1%
R17
4.64K
1%
C11
0.1
R21
49.9,1%
T1
S1
S2
F2,S3
F1
F3
75110068
E5
E6
C9
0.01
R19
49.9
1%
R20
2.15K
1%
Q8
2N3906
Q7
2N3904
R22
49.9
1%
R18
100
1%

HIGHEST REFERENCE DESIGNATOR			
L2	Q8	T1	UCR2
K1	R22	J1	E6

1. UNLESS OTHERWISE SPECIFIED:
   - A. ALL RESISTANCE VALUES ARE OHMS, 1/8W,1%.
   - B. ALL CAPACITANCE VALUES ARE MICROFARADS.
   - C. ALL INDUCTANCE VALUES ARE MICROHENRIES.

NOTES:

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TOLERANCES UNLESS OTHERWISE SPECIFIED		
DECIMALS	FRACTIONS	ANGLES

MATERIAL

ADVANCED NAVIGATION INC

SCHEMATIC,
ANTENNA COUPLER

10310550	5300M		
NEXT ASSY	USED ON	REF DES	FIG NO

ENGR 2-3-88
CHECKED

SIZE	CODE IDENT NO		
3		12310551	A